Member of the State Board of Agriculture from February, 1864, to the date of his death, December 14th, 1873. For his last lecture, see p. 222. See also pp. 405–6.

TWENTY-FIRST ANNUAL REPORT

OF THE

SECRETARY

OF THE

Massachusetts Board of Agriculture,

WITH AN APPENDIX

CONTAINING

REPORTS OF DELEGATES APPOINTED TO VISIT THE COUNTY EXHIBITIONS,

AND ALSO

RETURNS OF THE FINANCES OF THE AGRICULTURAL SOCIETIES,

FOR

1873.

BOSTON:
WRIGHT & POTTER, STATE PRINTERS,
CORNER OF MILK AND FEDERAL STREETS.
1874.

STATE BOARD OF AGRICULTURE—1874.

MEMBERS EX OFFICIIS.

His Excellency WILLIAM B. WASHBURN.
His Honor THOMAS TALBOT.
HON. OLIVER WARNER, *Secretary of the Commonwealth.*
WILLIAM S. CLARK, *Pres. Mass. Agricultural College.*
CHARLES A. GOESSMANN, *State Agricultural Chemist.*

APPOINTED BY THE GOVERNOR AND COUNCIL.

	Term Expires.
JAMES F. C. HYDE, *of Newton,*	1875
PAUL A. CHADBOURNE, *of Williamstown,*	1876
MARSHALL P. WILDER, *of Boston,*	1877

CHOSEN BY THE COUNTY SOCIETIES.

Massachusetts,	CHARLES S. SARGENT, of Brookline,	1877
Essex,	GEORGE B. LORING, of Salem,	1875
Middlesex,	JOHN B. MOORE, of Concord,	1876
Middlesex North,	JONATHAN LADD, of Lowell.	1877
Middlesex South,	JOS. N. STURTEVANT, of So. Framingham,	1875
Worcester,	O. B. HADWEN, of Worcester,	1875
Worcester West,	THOMAS P. ROOT, of Barre,	1875
Worcester North,	EUGENE T. MILES, of Fitchburg,	1875
Worcester North-West,	COURTLON SANDERSON, of Phillipston,	1877
Worcester South,	DANIEL DWIGHT, of Dudley,	1877
Worcester South-East,	WILLIAM KNOWLTON, of Upton,	1876
Hampshire, Franklin & Hampden,	ELNATHAN GRAVES, of Williamsburg,	1876
Hampshire,	LEVI P. WARNER, of Sunderland,	1877
Highland,	JONATHAN McELWAIN, of Middlefield,	1875
Hampden,	HORACE M. SESSIONS, of Wilbraham,	1876
Hampden East,	HORACE P. WAKEFIELD, of Monson,	1876
Union,	FRANKLIN C. KNOX, of Blandford,	1877
Franklin,	WHITNEY L. WARNER, of Sunderland,	1877
Deerfield Valley,	ROGER H. LEAVITT, of Charlemont,	1875
Berkshire,	ENSIGN H. KELLOGG, of Pittsfield,	1876
Hoosac Valley,	JOHN M. COLE, of Williamstown,	1876
Housatonic,	HENRY S. GOODALE, of Mt. Washington,	1876
Norfolk,	ELIPHALET STONE, of Dedham,	1877
Hingham,	ALBERT FEARING, of Hingham,	1876
Bristol,	AVERY P. SLADE, of Somerset,	1875
Bristol Central,	JOHN A. HAWES, of Fairhaven,	1876
Plymouth,	CHARLES G. DAVIS, of Plymouth,	1875
Marshfield,	GEORGE M. BAKER, of Marshfield,	1876
Barnstable,	S. B. PHINNEY, of Barnstable,	1877
Nantucket,	ANDREW M. MYRICK, of Nantucket,	1876
Martha's Vineyard,	HEBRON VINCENT, of Edgartown,	1877

CHARLES L. FLINT, *Secretary.*

TWENTY-FIRST

ANNUAL REPORT OF THE SECRETARY

OF THE

BOARD OF AGRICULTURE.

To the Senate and House of Representatives of the Commonwealth of Massachusetts.

The year just passed has been one of general prosperity to the farming community, notwithstanding the forebodings through the opening spring caused by a drought of more than usual severity at that season of the year. The first crop of hay was light in the eastern and middle portions of the State, though more frequent showers on the hilly ranges west of the Connecticut and in Berkshire County carried the crop through to a more satisfactory yield there, while the favorable conditions of the later season, and the uncommonly late occurrence of frosts in the fall, produced an abundant second crop of grass and a luxuriant growth of fall feed.

The general tone of the farming community, therefore, has been hopeful, and it was a matter of common remark that the attendance upon the agricultural exhibitions was never better. Where the conditions as to weather were favorable, the societies have been prosperous and their receipts large, while the display of improved stock, farm and orchard products, and of domestic industry, has given abundant evidence of thrift and progress.

The societies of this State have, no doubt, been productive of great good. They have created an interest and enthusiasm

in many sections where little or none existed before, and led many to a higher level of thought and effort. They should be conducted with a high-toned integrity of purpose, and so as to commend themselves to the confidence and respect of the community; more with reference to the good they are organized to accomplish than to any temporary sensation that it may be in the power of the management to create.

It may be questioned whether the track that has come to be considered so essential to the success of the modern agricultural "fair" has not led to the growth of abuses which ought to be corrected. Wherever such abuses exist, it is the part of wisdom for the societies themselves to take the initiative in their correction, rather than to wait till the better part of the community feel compelled to avoid and to frown upon them.

The societies should realize more fully, the magnitude, the dignity and the character of the mission they have to perform in the development of the material interests of the Commonwealth. They have it in their power to lift the labor of the people to a higher plane of thought, and to lead the way to higher triumphs of skill and intelligence; but it is questionable whether this can be done by catering to the lower tastes of the public, or aiming too exclusively to create a present sensation and excitement such as are too often apparent in the trials of speed at some of our shows.

There is a legitimate and proper exhibition of the qualities and the power of the horse, and to this limit no reasonable objection would be likely to be made; but when, as in too many instances, the trials of speed are allowed to absorb the too exclusive attention of the public, and of the officers of the society, the exhibitors in other departments of a show will very naturally complain, and they will be sustained in their criticisms by a large and respectable portion of the community, till it comes to be pretty generally admitted that the exhibition is managed in the interest of a class, to the partial exclusion of other classes equally important, and perhaps, more deserving of official encouragement. Whether such a verdict is just or not, it is desirable to conduct the affairs of a society in such a manner that there shall be no reasonable ground for question as to the motives and objects of the management.

There is reason for congratulation, that we have had a more than usual exemption from disease among the stock of the farm during the past year. While England and other countries from which we are making frequent importations, either directly or indirectly, are still suffering great losses from contagious or epizoötic diseases, we cannot be too constantly on our guard against invasion from abroad. The experience we had a few years ago, ought not to be forgotten. An inspection sufficiently rigid to detect the first appearance of any contagious or dangerous disease in our stock, can be maintained at a cost quite trifling compared with the losses which a neglect of suitable precaution might entail, and the continuance of the Board of Cattle Commissioners would seem to be wise, as affording some means of safety in an emergency such as we have had in former years, and such as we are certainly liable to at any future time. The Commission, as now constituted, is at no expense of any account to the Commonwealth. It affords a nucleus for prompt and energetic action in case of necessity, and so is, to some extent, a security against being taken by surprise, as we were in 1859.

PUBLIC MEETING OF THE BOARD,

At FITCHBURG.

The country meeting of the Board was held in Fitchburg, December 2d, 3d and 4th, and was very fully attended.

The sessions commenced on the morning of Tuesday, December 2d, at the City Hall, and the meeting was opened by an address from Capt. Eugene T. Miles, chairman of the committee on meetings.

ADDRESS OF MR. MILES.

Gentlemen of the State Board of Agriculture:—By a custom or practice of long standing, the duty of calling this meeting to order devolves upon the chairman of the committee on meetings. It is not my purpose to detain you with any extended remarks, but I beg to say that the honor you have conferred upon us by selecting Fitchburg as the place for

holding this, the annual country meeting of the State Board of Agriculture, is highly appreciated, not only by those immediately interested in agriculture, but by all intelligent citizens of this city, and of the surrounding towns, engaged in the various pursuits of life; and in their behalf I extend to you their thanks.

Fitchburg was incorporated as a town in 1764, and here, as well as elsewhere in Massachusetts, agriculture was the chief occupation of its inhabitants, and their entire support was derived from the products of the soil.

Nature has not been lavish in her agricultural gifts; on the contrary, the contour of this region of country was uneven, rough, and even rugged, presenting serious obstacles to the growth and prosperity of the town.

Add to this what was, in the earlier years of its settlement, considered an almost insuperable objection—the north branch of the Nashua River, passing through the entire length of the town, with its various tributaries, sensitive in the extreme to the rains, showers and melting snows, on account of the abruptness of its many hills, causing the frequent destruction of the roads and bridges, and it is not surprising that her early growth was slow.

Worcester North is preëminently a manufacturing region. The dividing line of the waters flowing to the Atlantic on the east and to the Connecticut on the west passes through its centre from north to south, and, what seemed to be so detrimental to the interests of its people early in the present century, has proved, under their enterprise, energy and intelligence, the principal source of its present prosperity. The waters of the Nashua on the east, and those of Miller's River on the west, in their respective courses turn the thousand wheels located on the numerous sites, around which the thriving towns and villages with their thousands of busy inhabitants cluster. Notwithstanding manufacturing is so large an interest in this locality, underlying and coöperating with, and sustaining it to a great degree, is agriculture. In passing through the halls of the New York State Agricultural Society at Albany, recently, I observed prominently posted the following: "Agriculture feeds us, to a great extent it clothes us; without it we could not have manufactures, we should not

have commerce; these all stand together, but they stand like pillars in a cluster, the largest in the centre and that largest is agriculture."

These truthful words were spoken many years ago by Daniel Webster, and, while the manufacturing and commercial interests of the country have made gigantic strides in progress, they are none the less truthful to-day than they were when they fell from the lips of the departed statesman and farmer. No pains have been spared to give publicity to this meeting, and it is hoped that such audiences will be assembled here as will assure you that your selection of this place for the holding of this meeting was a wise one, a judicious one and a happy one. That we need in our agricultural interest in Worcester North the influences of the deliberations, discussions, essays and lectures that are to be had here, cannot be gainsaid; and there is vast opportunity for successfully and profitably increasing this main pillar of industry in our midst. Here we have a ready market at remunerative prices for all the various products of the soil, but it is believed that our farmers would not fail to receive satisfactory returns in the specialties of small fruits and garden vegetables.

Very little butter is produced here that finds its way to market; and cheese of home manufacture is rarely seen in our stores. Not a can of milk produced here is sent away; on the contrary, Leominster, Lunenburg, Ashby and Westminster contribute largely to our supply.

It is safe to say that not one-fourth of the quantity of lettuce, spinach, cucumbers, pease, beans, celery, beets, turnips, cabbages and squashes consumed by our people are the product of our own soil. We are dependent upon the Boston markets for the larger part of our supply of these necessary articles of daily diet. In small fruits, the field is larger still for their disposition. No adequate supply of strawberries, blackberries, raspberries, currants and other small fruits has ever been found in our markets and a large proportion of what we have had, has come from abroad. It is hoped that a greater interest in this direction may be infused by the transactions of this meeting.

Welcome to the hospitalities of our citizens and to our

young city will be extended to you by its chief magistrate, Hon. Amasa Norcross, whom I now have the honor and pleasure to present to you.

ADDRESS OF MAYOR NORCROSS.

Gentlemen of the Board of Agriculture:—Our friend Capt. Miles, a member of your Board, knowing with what pleasure the people of Fitchburg have anticipated this meeting, has arranged to have me speak a word of welcome in their behalf. I could wish, gentlemen, that your coming had fallen in a different season of the year. We are not without a pardonable pride in the beauties of our natural scenery, and would gladly challenge your admiration for it, as seen under summer skies; but the fuller attendance upon your instructions at this season is an ample compensation for such loss. As it is, gentlemen, permit me to extend in behalf of the citizens of our city a cordial welcome to the hospitalities of their homes.

There are abundant reasons why the people of this city should welcome you. The desire for further light, for further knowledge upon subjects pertaining to agriculture, is a strong one in the minds of those engaged in its pursuits, but he makes a grave mistake who thinks that a manufacturing population like our own, has no interest in the matters that you have come to discuss. Many of us who have no share in your pursuits, read with deep interest the proceedings of this Board, knowing that improvement in agriculture is an advantage to manufacturers; that their interests are so interwoven, that though our people are chiefly devoted to other avocations, I think your presence could not give greater satisfaction to a community composed wholly of farmers. Moreover, the instruction gained here will be communicated by hundreds of persons in this vicinity, at meetings of the local societies; the local press will extend it, and thus its influence will be widely disseminated. In behalf of the citizens of Fitchburg, and for myself as well, I thank you for your coming, and again extend a most hearty welcome, hoping that the time here spent may prove as agreeable to you as it will be instructive to us.

President CLARK, of the Agricultural College, was then invited to take the chair, and he stated that the first business in order was a paper upon

A HUNDRED YEARS' PROGRESS OF AMERICAN AGRICULTURE.

BY CHARLES L. FLINT.

Mr. Chairman and Gentlemen:—The paper which I am about to present to you was written with the design of creating some interest in the minds of the farming community as a preparation for the Centennial of 1876. It was prepared at the request of the Commissioner of Agriculture at Washington for his last Report, but as Congress refused to publish that Report, there appears little probability that it will be generally accessible to the people in that form, and hence several members of the Board have requested that it be submitted at this meeting.

The Centennial Celebration, to take place in the city of Philadelphia in the year 1876, is to be a memorial of the struggles, the sacrifices, the heroic endurance, and the triumphs of our fathers in founding a free government, claimed to be the highest type of civil polity which the world has ever seen. As the time draws nigh, this grand occasion appeals to the pride, to the patriotism, to the reverence for the past, to the memory of the dead, to the highest and most unselfish feelings of every American heart, to make it a success, and, beyond all question, the grandest event of the sort which mankind has ever beheld. Anything short of this will fail of its purpose.

It is true the happiness and prosperity of a nation depend upon the union and the harmonious development of every variety of industrial pursuit; but the groundwork and the pillar of civilized society, on which its prosperity, its solidity and its glory must ultimately rest, is agriculture, the production of the means of sustaining a rapidly growing population. Commerce draws its life-blood from this; manufactures grow out of it. "They all stand together," as Webster said, "like pillars in a cluster, the largest in the center, and that largest is agriculture."

A glance at the history of this great industry in the United States will therefore be found to possess much that is interesting, instructive and useful.

BEFORE THE REVOLUTION.

There is little need to look beyond the period of the Revolution in search of the first steps at any real progress in the agriculture of this country. The first European settlers upon these shores had to begin life anew, as it were, in the midst of untold hardships, privations, and dangers. They found a climate widely different from any which they had known before; a soil which the foot of civilized man had never trod, and natural productions which they had never seen. They brought with them little or no experience which could have fitted them for the rude struggle with nature in which they were about to engage. This they were forced to gain, painfully and laboriously enough, with the axe in hand to clear the forest, and the gun by their side to defend their lives. That progress in agriculture should have been slow is not, therefore, a matter of surprise. We must rather wonder that they got on at all in the struggle for life.

The different colonies, no doubt, had a somewhat different experience. The winters of Virginia were milder than those of New England, and the settlers on the James River suffered less from this cause than those farther north, but all were alike surrounded by a wilderness infested by savage men and by wild beasts, always ready to prey upon their live stock or to destroy their crops. For some months after landing there were, indeed, no cattle to be destroyed. The first animals imported into the colonies were those that arrived at the James River plantation some time previous to 1609, the exact date of their arrival not being known. In 1610 several cows were landed there, and a hundred more in 1611. The first may have been brought by the early adventurers, either at the time of their first voyage, in 1607, or soon after, but the later additions probably came from the West Indies, being the descendants of the cattle brought to America, in his second voyage, by Columbus, in 1493.

So important was it considered that the cattle should be allowed to increase and multiply that, according to old

authority, an order was passed forbidding the destruction of domestic animals, on pain of death to the principal, burning of the hand and cropping the ears of the accessory, and a sound whipping for the concealer of the facts. Such being the nature of the encouragement to the raising of stock, the number of cattle in the Virginia colony increased to about five hundred head in 1620, and to about thirty thousand in 1639, while the fact that the number had decreased to twenty thousand in 1648, would seem to indicate that the restriction had been removed. Many also had been sent to the colonies further north.

FIRST CATTLE IN NEW ENGLAND.

The first cattle that were brought to New England arrived at Plymouth in 1624, in the ship Charity. They were imported for the colony by Gov. Winslow, and consisted of three heifers and a bull. They possessed no uniformity of color, being black, black and white, and brindle. In 1626 twelve cows were sent to Cape Ann, and in 1629 thirty more, while in 1630 about a hundred were imported for the "governor and company of the Massachusetts Bay in New England." In the meantime a hundred and three cattle and horses were imported into New York from the island of Texel, Holland, by the Dutch West India Company; and in 1627, the settlements along the Delaware were supplied by the Swedish West India Company, so that by the year 1630 the number of horned cattle in all the colonies must have risen, by importations and by natural increase, to several thousands, to which were added in 1631, 1632, and 1633, many yellow cattle from Denmark, brought over by Captain John Mason, who was engaged in extensive lumbering operations along the Piscataqua River, in New Hampshire.

These were the sources from which our common or "native" cattle sprang. The earlier importations were undoubtedly more extensive than any subsequent ones, the colonists relying upon the natural increase to supply their wants, but there is historical evidence to show that there was more or less interchange of stock between the various colonies at an early date, and that this resulted in a mixture of blood, such as we find it now in our common stock.

We are to bear in mind, also, that the stock of the mother country and of various other countries from which the supplies of the colonists were drawn was not at that time improved as we find it in the present day. It was long before the interest in the improvement of stock had been awakened, and it is a historical fact that the ox of that day was small and ill-shaped, quite inferior to the ox of our own time; that the sheep has undergone a vast improvement, both in the fineness and value of its wool and the size and quality of the carcase, within the last century; that throughout the earlier part of the last century the average gross weight of the neat cattle sent to Smithfield market did not exceed three hundred and seventy pounds, and that of sheep twenty-eight pounds, while the average weight of the former is now over eight hundred pounds, and of the latter over eighty pounds. Nor is it probable, on account of the high price of cattle at that period, and the risks to which they were exposed, that the colonists obtained the best specimens then known. In fact the difference in animals, and what are now considered the best points and the highest indications of improvement, were nowhere understood or appreciated two centuries ago. That the cattle of the early settlers were poor of their kind, as compared with our ideas of the quality of similar animals, is, therefore, plain enough to be understood.

TREATMENT OF CATTLE.

In addition to this, the means of keeping stock of any kind, in such a manner as to secure any improvement in it, were not at hand. The early colonists had no notion of raising grass or hay for their animals by artificial means. They relied chiefly, and almost from necessity, upon the production of natural meadows and the grasses upon the salt-marshes along the sea-shore. The cattle, like their owners, had to browse for their lives, and through the long northern winters to live upon poor and miserable swale-hay. Death from starvation and exposure was not uncommon, and sometimes an entire herd fell victims to the severity of the season. The most terrible droughts were of frequent occurrence, and caused great distress. The Indian corn and the grasses perished to such an extent that both grain and forage for

stock, at times, had to be imported from England, to keep the people from starving, and to keep the cattle alive, even so late as 1750.

Of the mode of keeping cattle in the Virginia colony, Glover, a contemporary, as appears by the Historical Register, says: "All the inhabitants give their cattle in winter is only the husks of their Indian corn, unless it be some of them that have a little wheat straw, neither do they give them any more of these than will serve to keep them alive;' by reason whereof they venture into the marshy grounds and swamps for food, where very many are lost." And Clayton, another contemporary authority, says that "they neither housed nor milked their cows in winter, *having a notion that it would kill them.*" A still later Swedish traveler, Kalm, after whom our beautiful mountain laurel, the Kalmia, was named, in speaking of the James River colony, in 1749, says:

"They make scarce any manure for their corn-fields, but when one piece of ground has been exhausted by continual cropping, they clear and cultivate another piece of fresh land, and when that is exhausted proceed to a third. Their cattle are allowed to wander through the woods and uncultivated grounds where they are half starved, having long ago extirpated all the annual grasses by cropping them too early in the spring, before they had time to form their flowers or to shed their seeds."

This statement will apply with nearly equal force to the other colonists at that date. That the description is strictly correct, I may quote from a distinguished Virginian, the Hon. James M. Garnett, who, in 1842, said:

"Previous to our Revolutionary war, as I have been told by the farmers of that day, no attempts worth mentioning were made to collect manure for general purposes, all that was deemed needful being saved for the gardens and tobacco-lots, by summer cow-pens. These were filled with cattle such as our modern breeders would hardly recognize as belonging to the bovine species. In those days they were so utterly neglected that it was quite common for the multitude starved to death every winter to supply hides enough for shoeing the negroes on every farm. This was a matter so generally and

constantly anticipated, that my own grandfather, as I have heard from unquestionable authority, was once very near turning off a good overseer because cattle enough had not died on the farm of which he had the supervision to furnish leather for the above purpose. When any cattle were fattened for beef, almost the only process was to turn them into the cornfields to feed themselves. Sheep and hogs were equally neglected."

BEGINNING OF GRASS CULTURE.

In order to realize still more fully the condition of the early settlers, so far as the treatment of their stock is concerned, we are to consider that no attention was paid to the culture of the grasses, even in England, in the early part of the seventeenth century, and that very few of the roots now extensively cultivated and used as food for stock had been introduced there. The introduction of red clover into England did not take place till 1633; that of sainfoin, not till 1651; that of yellow clover, not till 1659; that of white or Dutch clover, not till 1700. Of the natural grasses, our well-known timothy was first brought into cultivation in this country, and it was not cultivated in England until the year 1760. The culture of orchard grass was first introduced into England from Virginia in 1764. There is no evidence of any systematic or artificial cultivation of grasses there until the introduction of the perennial rye grass in 1677, and no other variety of grass-seed appears to have been sown for many years; not, indeed, till toward the close of the last century, upon the introduction of timothy and orchard grass. The *Edinburgh Quarterly Journal of Agriculture*, the highest authority in such matters, says the practice of sowing grass-seed was never known in Scotland previous to the year 1792. Such being the case, in a climate so severe as that of Scotland, it is not at all surprising that the custom in this country dates back only little more than a hundred years.

It is a somewhat curious fact that the modern improvements in cattle in England did not begin till after the systematic culture of the higher qualities of natural grass. It is not strange, therefore, that the colonists here, who had vastly greater hardships to encounter in the practical operations of

the farm, were slow to recognize the possibilities of improvement, or that their cattle, poor as they must have been at the outset, continued rather to depreciate than to improve in quality until sometime after the Revolution. The number increased, however, as the range of pasturage or browsing grounds was comparatively unlimited, so that the keeping of stock may be said to have assumed some importance in the older settlements, by the middle of the last century, when it had become comparatively safe from molestation.

EARLY FARM IMPLEMENTS.

One of the chief obstacles the early colonists had to encounter, to add to the hardships of their lot in the cultivation of the soil, was the difficulty of procuring suitable implements. A few, no doubt, were brought with them, but all could not obtain them in this way, and the only metal they had was made of bog-ore, and that was so brittle as to break easily and put a stop to their day's work. Most of their tools were made of wood, rude enough in construction, and heavy of necessity, and little fit for the purpose for which they were made. The process of casting steel was then unknown. It was discovered in Sheffield, England, but not till the middle of the last century, and then kept a secret there for some years. The few rude farming tools they had were for the most part of home manufacture, or made by the neighboring blacksmith as a part of his multifarious business, there being little idea of the division of labor, and no machinery by which any particular implement could be exactly duplicated.

PLOUGHS.

But it is recorded that as early as 1617 some ploughs were set to work in the Virginia colony, for in that year the governor complained to the company that the colony "did suffer for want of skilled husbandmen and means to set their ploughs on work; having as good ground as any man can desire, and forty bulls and oxen, but they wanted men to bring them to labor, and iron for the ploughs, and harness for the cattle. Some thirty or forty acres we had sown with one plough, but it stood so long on the ground before it was reaped it was most

shaken, and the rest spoiled with the cattle and rats in the barn." A contemporary resident of that colony says, in 1648, "We have now going near upon a hundred and fifty ploughs," and they were drawn by oxen. In 1637 there were but thirty-seven ploughs in the colony of Massachusetts Bay, and for twelve years after the landing of the Pilgrims the farmers had no ploughs, but were compelled to tear up the bushes with their hands, or with clumsy hoes and mattocks. It afterwards became the custom in the Massachusetts colony, for some one owning a plough to go about and do the ploughing for the farmers over a considerable extent of territory, and a town sometimes paid a bounty to any one who would keep a plough in repair for the purpose of going about to work in this way. The massive old wooden plough required a strong team, a stout man to bear on, another to hold, and a third to drive. The work it did was slow and laborious. The other tools were a heavy spade, a clumsy wooden fork, and, later, a harrow. I have had in my possession specimens of these forks, two hundred years old. It is difficult to see how they could have been made do very effective work.

ON THE MISSISSIPPI.

The ploughs used by the French settlers upon the "American bottom," in Illinois, from the time of their occupation, in 1682, down to the war of 1812, were made of wood, with a small point of iron fastened upon the wood by strips of raw-hide, the beams resting upon an axle and small wooden wheels. They were drawn by oxen yoked by the horns, the yokes being straight and fastened to the horns by raw-leather straps, a pole extending back from the yoke to the axle. These ploughs were large and clumsy, and no small plough was in use among them to plough among corn till about the year 1815. They used carts that had not a particle of iron about them.

Among the forms of the old wooden plough that achieved something more than a local reputation during the last century was that known as the "Carey plough." It was more extensively used than any other, though its particular form varied very much according to the skill of each blacksmith or wheelwright who made it. The land-side and the standard were

made of wood, and it had a wooden mould-board, often roughly plated over with pieces of old saw-plate, tin, or sheet-iron. It had a clumsy wrought-iron share, while the handles were upright, held in place by two wooden pins. It took a strong man to hold it and about double the strength of team now required to do the same amount of work. The "bar-share plough," sometimes called the "bull plough," was also used. A flat bar forming the land-side, with an immense clump of iron, shaped like half a lance-head, into the upper part of which a kind of colter was fastened, which served as a point. It had a wooden mould-board fitted to the iron-work in the most bungling manner. A sharp-pointed shovel, held with the reverse side up, and drawn forward with the point in the ground, would give an idea of its work. Then there was the "shovel plough," in very general use in the middle and southern colonies; a roughly-hewn stick was used for a beam, and into this another stick was framed, upon the end of which there was a piece of iron, shaped a little like a sharp-pointed shovel. The two rough handles were nailed or pinned to the sides of the beam. A plough known as the "hog plough" was also used in some parts of the country in the last and early part of the present century, so called probably on account of its rooting propensity. Specimens of this plough were taken to Canada in 1808 for use there, which would seem that it was thought to be one of the best ploughs then made. These old forms of the wooden plough continued to be used with little or no improvement till sometime after the beginning of the present century. The wooden plough was liable to rapid decay.

As for most of the other implements of husbandry, they were very few and very rude. The thrashing was done with the flail. The winnowing was done by the wind. Slow and laborious hand-labor for nearly all the processes of the farm was the rule, and machine labor the exception, till a comparatively recent date. Indeed, it has been said that a strong man could have carried on his shoulders all the implements used on his farm, except, perhaps, the old wooden cart and the harrow, previous to the beginning of the present century, and we know that the number as well as the variety of these tools was extremely small.

EARLY MODES OF CULTIVATION.

Of the crops raised by the early settlers, and upon which they relied chiefly for sustenance, Indian corn, pumpkins, squashes, potatoes, and tobacco, were mostly new to them. Few Europeans had ever seen them cultivated previous to their arrival here, but necessity soon showed their value, and from the Indians they learned how to grow them. It was a method followed with little change down to the opening of the present century. It was to dig small holes in the ground about four feet apart, put in a fish or two, drop the seed, four or six kernels of corn, and cover it up. The instrument used by the Indians for this purpose was made of a large clam-shell, but the colonists soon substituted the heavy mattock or grub-hoe. The James River settlers, under the tuition of the Indians, began to raise corn in 1608, and within three years after they appear to have had as many as thirty acres under cultivation. The Pilgrims found it under cultivation by the Indians on their arrival at Plymouth, and began its culture in 1621, manuring, as the Indians did, with alewives, then called "shads." An early chronicle of the Pilgrims says, "According to the manner of the Indians, we manured our ground with herrings, or rather shads, which we have in great abundance and take with great ease at our doors." And later: "You may see in one township a hundred acres together set with these fish, every acre taking a thousand of them; and an acre thus dressed will produce and yield so much corn as three acres without fish." In 1623 the drought was so severe and long protracted that the corn, planted very shallow and manured with these fish in the hill, soon began to wither and curl up, and on the higher lands it was ruined. And so in many years succeeding.

WHEAT.

Wheat was first sown by Gosnold, on Cuttyhunk, one of the Elizabeth Islands, in Buzzard's Bay, as early as 1602, when he first explored the coast. In Virginia, the first wheat appears to have been sown in 1611, and its culture continued to increase there till, in 1648, it is recorded that there were several hundred acres of it. But it soon after fell into great

disrepute as a staple crop, as the tobacco culture was found to pay a great deal better. For more than a hundred years after it was but little cultivated in that colony. Wheat was early cultivated by the Dutch colony of the New Netherlands, for it is recorded that in 1626 samples of that grain were taken to Holland to show what could be done in the new country. It is probable that the Plymouth colony began its culture within two or three years of the settlement, though there appears to be no distinct record of it until 1629, when wheat and other grains for seed were ordered from England.

But though the cultivation of wheat was begun almost simultaneously with the settlement of the several colonies, it did not attract very great attention for more than a century, Indian corn and, later, potatoes being relied upon for food to a much greater extent. It was soon found to be subject to blast and mildew in the eastern colonies. In July of 1663 "the best wheat," according to an old manuscript diary that I have consulted, "as also some other grain, was blasted in many places so that whole acres were not worth reaping. We have had much drought the last summer, and excess of wet several other springs, but this of blasting is the most general and remarkable that I yet heard of in New England." But it was "heard of" often after that, and to such an extent that it never became a very prominent crop in that part of the country. It is a matter of history that there never was a time in the eastern colonies when it was a sure and reliable crop, unless it be so now with our improved modes of tillage, deep ploughing, and thorough drainage.

RYE AND BARLEY.

Rye and barley were also introduced and cultivated by the early settlers, and it soon became the almost universal practice to mix the meal of the former with Indian meal in the making of bread. It is known to have been the custom as early as 1648, and probably it began at a considerably earlier date, perhaps as early as 1630. Oats were also introduced at the same time with rye. Captain Gosnold raised them with other grains on one of the Elizabeth Islands, on the southern coast of Massachusetts, in 1602. Though much more extensively grown than rye, they appear to have been used chiefly as food

for animals. The practice of sowing grass-seed, as we have seen, never became common in the colonies. It was not generally adopted till about the time of the Revolution, though here and there an individual farmer may have tried to see what he could do to help Nature clothe the surface of his old fields, but any general or systematic attempt to cultivate grasses for hay was wholly unknown and unthought of. This culture was of recent origin in this as well as in the mother country, and is the result of modern improvement in agriculture.

The culture of the potato, though introduced early in the history of the colonies, being among the seed ordered for the Plymouth Colony as early as 1629, was not recognized as a very important and indispensable crop till about the middle of the last century, when it had come to be widely known and esteemed as an article of food, for we know that in 1747 about seven hundred bushels were exported from South Carolina. It was the sweet potato that first came to be regarded as a delicacy in England, and the allusions of some rather early English writers undoubtedly refer to this, rather than the common potato.

CULTIVATION OF FRUIT.

Very little attention was paid to the raising of fruits previous to the Revolution, except for the manufacture of cider. The first apples were raised upon Governor's Island, in the harbor of Boston, from which, on the 10th of October, 1639, "ten fair pippens were brought, there being not one apple or pear tree planted in any part of the country but upon that island." The first nursery of young trees in this country was that planted by Governor Endicott on his farm at Salem, now Danvers, in 1640, and it is related that he sold five hundred apple-trees for two hundred and fifty acres of land. The systematic cultivation of fruit was not common in this country previous to the Revolution, nor did it become so till within the last fifty years. Orchards were set out upon many farms, but they were designed chiefly for cider. Much greater care, however, was taken to raise good fruits in New York, New Jersey, and Pennsylvania, than in New England, and several noted orchards and nurseries existed there in the latter part

of the last century and the early part of the present, but they were the exception to the general rule even there. Choice varieties of apples, pears, peaches, and cherries were known only to a few careful cultivators, and the number of varieties of these was quite limited as compared with the present day. Cider was plenty, but its quality was much less regarded than its quantity. It is stated that so late as 1824 there was not a nursery for the sale of apple and pear trees in New England. Trees had to be bought in New York or New Jersey, or imported from abroad. The first horticultural society in the country was established in New York, about the year 1820. It lived but eight or ten years, and then died. The Pennsylvania Horticultural Society was organized in 1827, and the Massachusetts in 1829. The orchard products, according to the last census, have now risen to $48,000,000, and the general culture of fruit is rapidly progressing.

We are now prepared to appreciate the condition of our agriculture at the time of the outbreak of the Revolution. We have seen that the settlers had but poor and inefficient tools, poor and profitless cattle, poor and meagre crops, and poor and miserable ideas of farming. They had no agricultural journals, no newspapers of any kind, and few books, except the old family Bible. There were less than a dozen papers published in the country at the middle of the last century. There was not one in New England at the beginning of that century, but four in 1750, and these had but a very limited circulation in the rural districts. There was little communication from town to town. The facilities for travel were extremely limited. It was before the days of many stages even, and the liberalizing influence which modern travel and social intercourse exert. Everything was favorable to the growth of prejudice and of narrow-minded views.

RESTRICTIONS ON COLONIAL AGRICULTURE.

Moreover, it is to be considered that throughout all the days of the colonies, from the very outset, the policy of the home-government was to make the provinces a source of

profit to the mother-country. It was a rigorous rule that all manufactured articles were to be procured of England. The colonies were not allowed to produce such articles for themselves, or to do anything which should come in conflict with the industry of the old country. But if there were any articles that England was in need of, the industry of the settlers was confined to them, and they could sell them only to England and buy what they required only of her. They encountered new restrictions at every turn. The grants or charters were issued, in some cases to individuals, in others to companies, and this involved, as it was clearly understood to involve, self-government; but the home-government very soon began to claim the right and the power of confirming the several governors. Some of the colonies were forbidden even to cut down pine trees suitable for ship timber, on any pretence. They were denied the right to export wool to any place out of the king's dominions, to sell land to anybody except subjects of the British Crown, to ship any produce except in English vessels, to coin money, to do anything, in fact, which could lessen their dependence upon the mother-country. Every new step taken, even in settling and working new lands, was met by some new and burdensome restraint, intended to keep the colonists in leading-strings. A formal act of Parliament, passed soon after the beginning of the last century, denied the right of the colonists to make hats. The home-government was very indignant at the custom which the people had of working up their wool and flax into home-spun cloth. They were forbidden to manufacture ore beyond the state of pig-iron. Thus the most oppressive restrictions bore upon colonial agriculture, as well as upon colonial commerce and manufactures, from the very outset of the settlements. They finally became so burdensome as no longer to be endured with patience, and led to an open rupture with the home-government, commonly known as the Revolution, at a time when the population of the whole country was considerably less than three millions, the general and popular estimate of three millions being supposed to be too high.

During the period of the Revolution farm production was brought to a partial stand-still, and, for some years after, it was in a state of extreme depression. It took time to recover from the effects of the struggle. Gradually, however, the importance of some effort to develop and improve the agriculture of the country was impressed upon the minds of the more intelligent and public-spirited of the people, men, for the most part, who were in advance of their time. The result of their deliberations was the formation of societies for the encouragement of agricultural improvement.

ORGANIZED EFFORT.

The South Carolina Agricultural Society was established in 1784; the Philadelphia Society for Promoting Agriculture, in 1785; the New York [city] Society, in 1791; the Massachusetts Society for Promoting Agriculture, in 1792. These were rather city than country institutions. They were very slow in reaching the common people. The average farmer of that day was not up to their standard of thought and observation. Their example, their teachings, their entreaties for aid, their reports and papers, fell comparatively dead upon the mass of the people. Farmers were not to be taught by men who never held the plough. They did not want anything to do with *theories*. Custom had marked out a road for them, and it was smooth and easy to travel, and, though it might be a circle that brought up just where it had started, it had the advantage, in the old farmer's mind, that in it he never lost his way. It didn't require any exertion of mind. His comfort, as well as his happiness, was based on a feeling of filial obedience to old usage that was hereditary in his being. It was born in the blood, and ruled him with an irresistible power. His field of vision was bounded and narrow, and his work was strictly *imitative*, so far as he could see, and in no way *experimental*. The old common law, based on precedent, custom, practice, was his guide and his rule. He would be governed by custom, not by reason. If ancient custom was *known* that was enough for him. It wasn't for him to doubt. To investigate would imply doubt. To investigate was to theorize. Theory is at the bottom of all investigation, and theory was a bugbear in his mind. The

logical result — that no improvement could be reached without investigation — had no terrors for him. He seldom read. The *written* word he received with distrust. It might contain principles, and it wasn't principles that he cared anything about, but *practice*. No matter whether founded on wisdom and experience or not, practice was the thing. It seemed to be his opinion that farming could not be improved though it might be injured by books. Its processes were so peculiar that they could be gained only by tradition.

It is probable that the events and the excitements of the Revolution itself, with the travel, the observation, and the social intercourse which it involved, had much to do with breaking up the impregnable barrier of prejudice and slavery to custom and precedent which ruled so strongly in the popular mind. Great passions which reach and stir up the lowest depths of the nation's heart have a liberalizing and progressive influence. They excite thought and awaken a spirit of inquiry. But that the picture is not in the least overdrawn is evident from the fact that here and there are a few specimens left to remind us that the leaven which the early societies infused among the people has not yet permeated the entire mass.

PUBLIC EXHIBITIONS.

But time brings its changes. Something more was felt to be needed, and a convention was held in Georgetown, in the District of Columbia, on the 28th of November, 1809, from which grew the Columbian Agricultural Society for the Promotion of Rural and Domestic Economy; and the first exhibition, probably, in this country, was held by that society on the 10th of May, 1810, with the offer of liberal premiums for the encouragement of sheep-raising, &c. Elkanah Watson exhibited three merino sheep in Pittsfield, Massachusetts, in the October following of the same year. It was an innovation upon old custom, and the occasion of much ridicule and contempt among the farmers of that day and generation, but it was the germ of the Berkshire County Agricultural Society, whose regular exhibitions began the year following, and are believed to have been the first county exhibitions ever instituted in this country.

The Massachusetts Society held its first exhibition at Brighton in 1816, offered a list of premiums, and instituted a ploughing-match; but it appears to have been rather with the design of testing the strength, training, and docility of the oxen than to improve the plough. The plough-maker, however, happened to be there with his eyes open, and there can be no doubt that this and similar exhibitions which soon followed gave a new impetus to the progress of agricultural mechanics.

CAST-IRON USED.

Improvements in the plough had begun, even before the close of the last century. A patent had been granted for a cast-iron plough to Charles Newbold, of Burlington, New Jersey, in 1797, combining the mould-board, share, and land-side, all cast together, and it was regarded by intelligent plough-makers as so great an improvement that Peacock, in his patent of 1807, paid the original inventor the sum of $500 for the right to combine certain parts of Newbold's plough with his own. The importance of this implement was so great as to command the attention and study of scientific men to improve its form and construction, and Thomas Jefferson, in 1798, applied himself to the task, and wrote a treatise upon the requisite form of the mould-board, according to scientific principles, calculating the exact form and size, and especially the curvature to lessen the friction. I have in my possession his original manuscript of this essay, containing his drawings and calculations.

But these changes and improvements were not readily adopted by the farming community. Their introduction was far slower than any new invention that promised to economize labor and do better work would be at the present day. Many a farmer clung to his old wooden plough, asserting that cast-iron poisoned the ground and spoiled the crops. He required an ocular demonstration before paying his money for an iron plough. It was not so much the weight of the old plough as the form of the mould-board, and the construction of the various parts, that needed correction. Its draught was great, on account of the excessive friction. The share and mould-board were so attached as to make too blunt a wedge. Its action was not uniform, and it was difficult to hold, requiring

constant watchfulness and great strength to prevent it from being thrown out of the ground. To plough to any considerable depth it was necessary to have a man at the beam to bear down. The mould-board was often shod with iron to lessen the friction and prevent wear, but it was usually in strips, often of uneven thickness, so that the desired effect was not always attained. The cast-iron plough remedied these serious defects, and secured at least some greater uniformity in construction. The modifications of the mould-board, which resulted from a better understanding of the true principles of construction, have enabled the farmer to do vastly better work, and a greater amount of it in the same time, and at a less expenditure of strength, and to reap larger crops as the result of his labor, while the cost of the implement, considering its greater efficiency and its durability, is less by half, probably, than the old wooden plough.

WHAT WE HAVE GAINED.

There can be no doubt that the saving to the country from these improvements in the plough, within the last half century, amounts to many millions of dollars a year in the cost of teams, and some millions in the cost of ploughs, or that the aggregate of crops has been increased by them many millions of bushels. The plough has also been modified to adapt it to a much greater variety of soils. In the mode of manufacture, too, a vast improvement has taken place. Half a century ago it was made sometimes on the farm, sometimes by the village blacksmith, and the wheelwright. The work is now concentrated in fewer establishments, which make it a specialty. In Massachusetts, for example, in 1845, there were seventy-three plough-manufactories, making 61,334 ploughs and other instruments annually, while in 1855 the number of establishments had decreased to twenty-two, which made 152,686 ploughs, valued at $707,176.86, annually. A very large plough-factory was established in Pittsburg, Pennsylvania, in 1829, and, as early as 1836, it was manufacturing as many as a hundred ploughs a day, by the aid of steam-power, to supply chiefly the Southern market. This establishment first made a hill-side revolving-beam plough, and the iron-centre plough, and more recently it has made a vast number of steel

ploughs, adapted to the prairie soils of the West. Another factory, in the same city, as early as 1836, made ploughs at the average rate of 4,000 a year. The two factories made 34,000 ploughs a year, valued at $174,000.

There are now many other still larger factories, some of which make from ten to twelve hundred different patterns, adapted to every variety of soil and circumstances.

No one can for a moment doubt the vast superiority of the best of the ploughs of the present day over the old forms in common use half a century ago. They have greater pulverizing power; they are less liable to clog; while in lightness of draught, ease of holding, durability, cheapness, perfection of mechanical work, quality of material, completeness with which the surface is inverted and the weeds or stubble buried, uniformity of wear, regularity of turning the furrow-slice, and other respects, we have made a vast and unquestionable improvement. In short, mechanical principles are better understood and more intelligently applied. We have combined simplicity of construction with economy of power. A better knowledge of the strength of materials has enabled us to reduce the size of all the parts of farming-tools, and so to avoid the clumsiness of the older style of implements, and, at the same time, to secure much more effective work. We have made some progress, also, in substituting the principle of the spade, or the fork, for that of the plough, as the use of the rotary spader is a sufficient proof. We have made some progress in the application of steam to the operation of ploughing, and the wonderful performances of the steam-plough, in the few instances where it has been tried, have indicated the possibilities of the future, and shown that the time is not far distant when we shall have it in our power to develop the resources of the great West to an extent and with an economy never yet dreamed of.

THE HARROW.

The importance of a complete and perfect pulverization of the soil, to admit of the extension of the roots of plants, and the access of air and moisture, was never more fully realized than at the present time. As it is at best but partially effected by the plough, which crumbles and breaks down the

soil simply in the process of turning, something farther has always been required, and the harrow has been used for this purpose, to follow the plough, from time immemorial. With the early settlers this implement, like most others, was made of wood, of simple bars and cross-bars, furnished with wooden teeth. It was usually home-made, rude and clumsy enough. The first improvement was the substitution of iron for wooden teeth, which were afterward pointed with steel, when it was made lighter, so as to admit of being moved more rapidly through the soil.

The changes and improvements of this implement came very slowly, and it is scarcely twenty years since it can be said to have approached perfection. It has now assumed a more compact form and greater flexibility, certain parts of the frame-work being hinged together, so that any part can be lifted or raised without disturbing the working of the rest, while particular forms have been made for special purposes, like the Shares and the Nishwitz, admirably adapted to mellowing the surface of newly broken land without tearing up the inverted sod. The rotary and the smoothing harrow may be mentioned, also, as a vast improvement upon the old styles. These and many other patterns, after which the harrow is made, seem to leave little to desire in the form and efficiency of this most important implement.

SMALLER FARM TOOLS.

A large class of the most valuable labor-saving implements may be mentioned which are almost entirely due to modern ingenuity, such as the cultivators, the horse-hoes, the grubbers, the drills and seed-sowers, and others of a similar character. By means of the horse-hoe and the cultivator the soil can be frequently stirred among growing crops, at a slight expense, thus enabling them to withstand the effects of drought, giving us, practically, a greater control over the seasons. Many of these smaller machines are wonderfully perfect and well adapted to the purpose for which they were constructed. And while mechanical invention has been active in this direction, our shovels, spades, hoes and forks have been vastly improved and made more effective, till, for lightness and finish, in combination with strength and durability, they are

unsurpassed by any similar tools in any part of the world; while the rapidity with which they can be manufactured, and the consequent cheapness with which they are sold, are among the marvels of modern mechanics.

The manufacture of these important articles was undertaken, to be sure, even before the Revolution, and as early as 1788 the iron-plated shovels made in Bridgewater, Massachusetts, gained the credit of being superior in workmanship to the best imported shovels of that day, and they undersold them at the same time. A large shovel-factory was established at Easton, Massachusetts, about seventy years ago, and as early as 1822 it was making about 30,000 shovels a year. By improvements in the process of manufacture, the patents for which were issued in 1827, the proprietor gained so high a reputation and such an increase of business, that by 1835 he was making about forty dozen shovels and spades per day, each shovel, in the systematic division of labor, passing through the hands of no less than twenty different workmen. The same establishment can now produce over two hundred and fifty dozen a day.

THE WORK CONCENTRATED.

It may be stated that cast-steel shovels were first patented in 1828, but cast-steel hoes were made by two different establishments in Philadelphia as early as 1823. Shovels and hoes were made at Pittsburg, Pennsylvania, in considerable quantities previous to the year 1803, and by the year 1831 steel hoes were made there so as to be sold at the rate of $4.50 a dozen, only half the price of the iron hoe ten years earlier. Two factories in that city, in 1836, were able to make steel hoes at the rate of 1,600 dozen, besides 8,000 dozen shovels and spades a year, in addition to a large quantity of other tools; while, in 1857, four large establishments there made 32,000 dozen hoes and 11,000 dozen planters' hoes, a half million dollars' worth of axes, and large quantities of picks, mattocks, saws, &c. These facts are alluded to simply to show how this industry has become concentrated in large establishments, where perfection can be attained by the division of labor. There are many similar establishments in various parts of the country.

But perhaps the most important of modern agricultural inventions are the grain-harvesters, the reapers, the mowers, the threshers and the horse-rakes. The sickle, which was in almost universal use till within a very recent date, is undoubtedly one of the most ancient of all our farming implements. Reaping by the use of it was always slow and laborious, while from the fact that many of our grains would ripen at the same time, there was a liability to loss before they could be gathered, and practically there was a vastly greater loss from this cause than there is at the present time.

THE CROWNING GLORY.

It is not, therefore, too much to say that the successful introduction of the reaper into the grain-fields of this country has added many millions of dollars to the value of our annual harvests, by enabling us to secure the whole product, and by making it possible for the farmer to increase the area of his wheat-fields, with a certainty of being able to gather the crop. Nothing was more surprising to the mercantile community of Europe than the fact that we could continue to export such vast quantities of wheat and other breadstuffs through the midst of the late rebellion, with a million or two of able-bodied men in arms. The secret of it was the general use of farm-machinery. The number of two-horse reapers in operation throughout the country, in the harvest of 1861, performed an amount of work equal to about a million of men. The result was that our capacity for farm production was not materially disturbed.

The credit of the practical application of the principles involved in this class of machines undoubtedly belong our own ingenious mechanics; for though somewhat similar machines were invented in England and Scotland many years ago, they had never been proved to be efficient on the field, and had never gained the confidence of the farmers, even in their neighborhood; while the patent issued to Obed Hussey, of Cincinnati, in 1833, and another issued to McCormick, of Virginia, in 1834, not only succeeded in the trials to which they were subjected, but gained a wide and permanent reputation. Many patents had been issued in this country previously, the first having been as early as 1803, but they had

not proved successful. Hussey's machine was introduced into New York and Illinois in 1834, into Missouri in 1835, into Pennsylvania in 1837, and in the next year the inventor established himself in Baltimore. McCormick's machine had been worked as early as 1831, but it was afterwards greatly improved, and became a source of an immense fortune to the inventor. He took out a second patent in 1845, fifteen other machines having been patented after the date of his first papers, including that of the Ketchum, in 1844, which gained a wide reputation.

NATIONAL TRIALS.

The first trial of reapers, partaking of a national character, was held under the auspices of the Ohio State Board of Agriculture in 1852, when twelve different machines and several different mowers were entered for competition. There was no striking superiority, according to the report of the judges, in any of the machines. A trial had been held at the show of the New York State Agricultural Society, at Buffalo, in 1848, but the large body of farmers who had witnessed it were not prepared to admit that the work of the machines was good enough to be tolerated in comparison with the hand-scythe. Some thought they might possibly work in straight, coarse grass, but in finer grasses they were sure to clog. The same society instituted a trial of reapers and mowers at Geneva in 1852, when nine machines competed as reapers and seven as mowers. Only two or three of the latter were capable of equalling the common scythe in the quality of work they did, and not one of them all, when brought to a stand in the grass, could start again without backing to get up speed. All the machines had a heavy side-draught, some of them to such an extent as to wear seriously on the team. None of them could turn about readily within a reasonable space, and all were liable to tear up the sward in the operation. The old Manning, patented in 1831, and the Ketchum machines were the only ones that were capable of doing work that was at all satisfactory. One or two of the reapers in this trial did fair work, and the judges decided that, in comparison with the hand-cradle, they showed a saving of $88\frac{3}{4}$ cents per acre. Here was some gain certainly, a little posi-

tive advance, but still most of the reapers, as well as the mowers, did very inferior work. The draught in them all was very heavy, while some of the best of them had a side-draught that was destructive to the team.

BEFORE THE WORLD.

The inventive genius of the country was stimulated by these trials to an extraordinary degree of activity. Patents began to multiply rapidly. Local trials took place every year in various parts of the country to test the merits of the several machines. The great International Exposition at Paris in 1855 was an occasion not to be overlooked by an enterprising inventor, and the American machines, imperfect as they were at that time, were brought to trial there in competition with the world. The scene of this trial was on a field of oats about forty miles from Paris, each machine having about an acre to cut. Three machines were entered for the first trial, one American, one English, and a third from Algiers, all at the same time raking as well as cutting. The American machine did its work in twenty-two minutes, the English in sixty-six, and the Algerian in seventy-two.

At a subsequent trial on the same piece, three other machines were entered, of American, English, and French manufacture, when the American machine did its work in twenty-two minutes, while the two others failed. "The successful competitor on this occasion," says a French journal, "did its work in the most exquisite manner, not leaving a single stalk ungathered, and it discharged the grain in the most perfect shape, as if placed by hand for the binders. It finished its piece most gloriously." The contest was finally narrowed down to three machines, all American. Two machines were afterwards converted from reapers into mowers, one making the change in one minute, the other in twenty. Both performed their task to the astonishment and satisfaction of a large concourse of spectators, and the judges could hardly restrain their enthusiasm, but cried out "Good, good!" "Well done!" while the excited people who looked on hurrahed for the American reaper, crying out, "That's the machine!" "That's the machine!" The report of a French agricultural journal said: "All the laurels, we are free to

confess, have been gloriously won by Americans, and this achievement cannot be looked upon with indifference, as it plainly foreshadows the ultimate destiny of the New World."

ANOTHER ADVANCE STEP.

Five years after the Geneva trial there was a general desire to have another on a scale of magnificence that should bring out all the prominent reapers and mowers of the country. The United States Agricultural Society accordingly instituted a national trial at Syracuse, New York, in 1857. More than forty mowers and reapers entered, and were brought to test on the field. It was soon apparent that striking improvements had been made since the meeting at Geneva. The draught had been very materially lessened in nearly all the machines, though the side-draught was still too great in some of them. Most of the machines could now cut fine and thick grass without clogging, and there was a manifest progress in them, but of the nineteen that competed as mowers, only three could start in fine grass without backing to get up speed. The well-known Buckeye, patented only the year before, won its first great triumph here, and carried off the first prize.

Every year now added to the list of new inventions and improvements. In 1859 the Wood mower was invented, and soon gained a high reputation. By the year 1864 there were no less than a hundred and eighty-seven establishments in the country devoted to the manufacture of reapers and mowers, many of them very extensive, and completely furnished with abundant power, machinery and tools of the most perfect description, while the work had become wisely and thoroughly systematized. The people directly sustained by these factories exceeded sixty thousand, while the value of their annual product exceeded $15,000,000, the number of machines amounting to one hundred thousand.

SOMETHING NEAR PERFECTION.

Nine years after the Syracuse trial, another exhibition of mowers and reapers, national in its character, was held at Auburn, New York, under the auspices of the New York State Society, in July, 1866. The number of mowers that

entered, single and combined, was forty-four; the number of reapers, thirty; or seventy-four in all. It was plain at a glance, that a decided improvement had taken place in workmanship and mechanical finish. The mowers were more compact, simpler in construction, lighter, and yet equally strong; they ran with less friction; the draught was easier, and the machines generally were less noisy; they cut the grass better, and were capable of working over uneven surfaces. The committee say in their report: "Those who had been present at former trials were astonished at the general perfection which had been attained by manufacturers of mowing-machines. Every machine, with two exceptions, did good work, which would be acceptable to any farmer; and the appearance of the whole meadow, after it had been raked over, was vastly better than the average mowing of the best farmer in the State, notwithstanding the great difficulties that had to be encountered. At previous trials, very few machines could stop in the grass and start without backing for a fresh start. At the present trial every machine stopped in the grass and started again without backing, without any difficulty, and without leaving any perceptible ridge to mark the place where it occurred."

We may here note the rapid progress of these most valuable labor-saving machines, for while, in the earlier trials, only one or two mowers met with any success whatever,—no one doing what practical farmers could call good work,—in this trial forty-two of the forty-four machines entered did their work well. In the early contests even a partial success was the rare exception; in the late, failure was the equally rare exception. In 1850 less than five thousand machines had been made and put into use, and few if any of them gave satisfaction. Now there is scarcely a farm of any size in the country but has its mowing-machine. It is one of the grandest agricultural inventions of modern times, and yet we see that it is less than twenty years since doubts were freely entertained as to whether it would ever become practically useful, whether the numerous mechanical obstacles would be entirely overcome. Its triumph has been complete. We have now many mowers that have not only a national but a world-wide reputation. The successful introduction of these ma-

chines was an immeasurable step in advance upon the old methods of cutting grass. They come in at a season when the work of the farm is peculiarly laborious, when labor is held at higher than the usual high rate of wages, when the weather is often fickle, either oppressively hot and trying to the physical system, or "catchy" and lowering, and they relieve the severest strain upon the muscles at the time of harvest. Our reapers are at the same time self-rakers. We can reap and gather from fifteen to twenty acres a day in the most satisfactory manner.

MAKING AND GATHERING HAY.

The horse hay-rake was invented at an earlier date than the mowing-machine. It has been used in this country nearly seventy years, and the saving by its use, sixty years ago, was estimated to be the labor of six men in the same time. The work to be performed in raking hay, though slow, is comparatively light. It does not require the exertion of a very great amount of strength. It is just such kind of work where the application of animal power becomes of the greatest advantage, because it multiplies the efficiency of the hand many times. The same thing is noticed in the use of the hand-drills for sowing small seeds, the tedder for turning and spreading hay, and in other similar operations. The labor of a good horse-rake is equal to that of eight or ten men for the same time, and from twenty to thirty acres a day can be gathered by a single horse and driver, and that without over-exertion. In the economy of labor the horse-rake must be regarded as second only in importance to the mower and the reaper, and is considered as essential upon the farm as the plough itself.

The tedder is another invention of still more recent date. With the introduction of the mower, by which grass could be cut so rapidly, and the horse-rake by which it could be gathered more rapidly than ever before, there was still wanting some means by which it could be cured proportionally quick, something to complete and round out the new system, as it were, to make the revolution in the process of hay-making entire. Various forms of the tedder had been patented and used in England, but they were too heavy and cumbersome

for American use, and it was left to our own inventors to meet and overcome the mechanical obstacles in the way of success here. This they have done, and we have so far economized labor in this direction, that the tedder is now regarded as of nearly equal importance with the mower and the horse-rake.

To these appliances for lightening and shortening the labors of haying, have been added many forms of the horse-fork for unloading and mowing away hay in the barn or upon the stack. Few machines have met with greater popular favor than the horse pitch-fork, for it saves not only the most violent strain upon the muscles, but economizes time, which, in the hurry of haying, is often of the utmost importance. The American hand-forks had been brought so near perfection, by their high finish, lightness and strength, as to leave little to be desired, but the horse-fork has been so generally introduced as, to a considerable extent, to supersede their use.

GRAIN SEPARATORS.

While these vast improvements have been going on with the other implements of the farm, the improvement in machines for threshing grain has been rapidly progressing, till they have reached a wonderful degree of perfection. Most of us can remember when the old-fashioned flail was heard upon almost every barn floor in the country. Here and there was a case where the grain was trodden out by cattle, with an amazing waste of time and labor. Compare those slow methods with the process, widely known at the present day, by which a horse-power or steam-power thresher not only separates the grain but winnows it, measures it, bags it ready for market, and carries away the straw to the stack, at the same operation, and all with a rapidity truly astonishing. The first successful attempt to construct a threshing-machine was made in this country in 1792, by Col. Anderson of Philadelphia. It answered the purpose well, but the inventor did not follow it up so as to secure its general introduction. Other patents were subsequently issued to American inventors, but they were not successful in introducing them. Scotch machines were introduced into New York, Pennsyl-

vania, and Delaware in 1802, but they were too complicated and were soon laid aside. An English machine was introduced in 1816 that proved a success in respect to speed and ease of cleaning grain, and portability, but subsequent inventions have so far surpassed all these comparatively early attempts, that they have superseded them, and later American machines have been used for many years.

As early as the Paris Exposition of 1855 the victory was won by an American machine. To ascertain the comparative rapidity and economy of threshing, six men were set to work at threshing with flails. In one hour they threshed 36 litres of wheat. In the same time Pitt's American machine threshed 740 litres; Clayton's English machine threshed 410 litres; Duvoir's French machine threshed 250 litres; Pinet's French machine threshed 150 litres. Speaking of this trial a French journal said: "This American machine literally devoured the sheaves of wheat. The eye cannot follow the work which is effected between the entrance of the sheaves and the end of the operation. It is one of the greatest results which it is possible to attain. The impression which it produced on the Arab chiefs was profound." Good as that machine was at that time, it has been greatly improved since then; and it is a fact that wherever our first-class machines have come into competition with those of European manufacture, they have invariably proved themselves superior in point of simplicity, rapidity, and perfection of work.

OTHER IMPLEMENTS.

Nor has the progress in the improvement of other indispensable machines of the farm been less marked and important. The smaller implements have felt the impress of the mechanical genius of the age. The corn-sheller has been brought to such perfection as to separate the corn from the ear with great rapidity, and with the application of little power. It has been adapted to horse-power also, and to different sections of country, where different varieties of corn are raised, and to shell one or two ears at the same time. Its economy of time and labor is such as, upon large farms, where the product is large, to pay for itself in a single year.

The hay-cutter is another machine of modern invention. Wherever a large stock of cattle is kept, especially where a considerable number of horses are wintered, it is often thought to be good economy to feed out more or less of the coarser feeding substances of the farm, as straw, corn-stover, the poorer qualities of hay, etc., by mixing them, either with the better qualities of hay or with some sort of concentrated food, like meal. The hay-cutter is adjustable so as to cut at different lengths, according to the wants of the stock for which it is designed. The point is to cut short and with perfect regularity, and when this quality is attained in a machine, uniting strength, simplicity, durability, and safety to the operator, it is estimated that there is a gain of about 25 per cent. in the economy of feeding, in the increase of thrift secured, and the positive advantage to be derived in the manure. There is a difference of opinion upon this point, to be sure, but notwithstanding that, the use of some form of the hay and straw cutter has become nearly universal, and is generally regarded as quite indispensable upon most well conducted farms. Machines for this purpose are made to be worked by hand upon small farms, and by horse or steam-power upon larger ones, where they are capable of reducing to chaff a ton and a half of hay or straw per hour.

Root and vegetable cutters have been brought to equal perfection, and where large stocks of sheep and cattle are kept, and vegetables are raised for winter feeding, as they are at the present time upon all well managed farms, the root-cutter is indispensable. By its use the farmer is now enabled to cut potatoes and other vegetables fine enough to feed to sheep, at the rate of a bushel in less than thirty seconds, by simple hand-power.

Nothing need be said of the innumerable variety of churns, hand cider-mills, the contrivances for gaining power in lifting stones and pulling stumps, ditching-machines, rollers, and a thousand other labor-saving machines which mechanical ingenuity has added to the stock of farm-tools, till the value of farming implements and machinery was reported, by the census of 1870, to be at least $336,878,429. The same was reported, in 1860, at $246,118,141, and in 1850 at only $151,587,638, a gain in twenty years of $185,290,791.

As evidence that the mechanical genius of the country is not yet exhausted, but is as untiring as ever, it may be stated that the patents issued for improvements in agricultural implements and machinery for the year 1872 exceeded one thousand, of which thirty-six were for rakes, one hundred and sixty for hay and grain harvesters and attachments, one hundred and seventy-seven for seed planters and drills, thirty for hay and straw cutters, ninety for cultivators, seventy-three for bee-hives, ninety for churns, and one hundred and sixty for ploughs and attachments ; and that the annual manufacture of agricultural implements amounts to over $52,000,000.

THE KING OF CEREALS.

Having alluded briefly to the wonderful progress made in the improvement of the implements of the farm, by means of which the possibility of production has been so largely increased, let us consider for a moment the practical results attained.

Indian corn has always been regarded as the great staple crop of the country. It is a plant of American origin. In the universality of its uses, and its intrinsic importance to mankind, no other grain can be compared with it. Its flexibility of organization is such that it readily adapts itself to every variety of climate and soil, from the warmest regions of the torrid zone to the short summers of Canada. The early settlers, as we have seen, found it in cultivation by the Indians, and it soon became the leading crop throughout the country, the crop upon which the colonists relied, not only for food, but for sale and exchange for other necessaries of life. It soon became a prominent article of export, especially from the Middle States,—New Jersey, Pennsylvania, and Delaware,—and, to some extent, from the States farther south. Thus, in 1748, South Carolina exported 39,308 bushels, and in 1754, 16,428 bushels. In 1755, there were exported from Savannah 600, and in 1770, 13,598 bushels. And so, in 1753, North Carolina exported 61,580 bushels; and the exports from Virginia, before the Revolution, sometimes amounted to 600,000 bushels a year. The total amount exported from all the colonies, in 1770, was 578,349 bushels. These figures

are not large, to be sure, when compared with the immense exportation of this grain at the present day, but they serve to show that, even before the Revolution, Indian corn had come to be regarded as an important money crop, as well as a prime necessity for home consumption. They show a surplus beyond the wants of the population at that time.

PRACTICAL RESULTS.

Nothing will more clearly demonstrate the exceedingly slow progress of our agriculture after the Revolution than the fact that, in 1791, the export of corn, including 351,695 bushels of meal, amounted to only 2,064,936 bushels; in 1800, to only 2,032,435 bushels, including 338,108 bushels of meal, while in 1810 it fell down to 140,996 bushels, of which 86,744 bushels were in the form of Indian meal. That was before the avenues to the great West were opened. It was at a time when the inland farmer had no available market, the cost of transportation of so bulky a product making it impracticable to team it to any great distance. It was before its real value as an article of human food was appreciated in Europe, and when its consumption as such was very small. It was before our cattle had been much improved, and when their number was much smaller than it is now, when it has come to be realized that it makes our beef, our mutton, our pork and our poultry.

Nor did the production materially increase till within the last forty years. The Erie Canal was not open till the year 1825; nor were there any railroads to facilitate the transportation of merchandise; but the gradual extension of settlements westward after that date, and the increase of population, led to an increase of production, till, in 1840, when this crop first appears in the census, the yield had risen to 377,531,875 bushels; and from that time its increase has been quite marvellous, for in 1850 it had reached to within a small fraction of 600,000,000 bushels (or, more nearly, 592,071,104), occupying 31,000,000 acres of land. Its value was reported at that date as $296,034,552. It was a gain of 57 per cent., or 214,539,229 bushels in ten years, while the increase of population in the same time was but 35 per cent. It formed about three-sixteenths of the whole agricultural production of the

country, occupied more than three-tenths of the improved land, and amounted to more than $25\frac{1}{2}$ bushels for each inhabitant. The export of this grain rose in value in 1856 to nearly $9,000,000.

This wonderful rapidity of increase continued, partly on account of the vast improvement in agricultural implements and the means of raising the crop, partly on account of the multiplicity of railroads and market facilities, till, in 1860, it amounted to 838,792,742 bushels; but it had fallen off somewhat in 1870, for it is reported then as 760,944,549 bushels, a portion of the land evidently having been devoted to wheat, which had very largely increased in the same time. When it is considered that our agricultural resources are still but partially developed, the product of this cereal appears to be truly amazing.

WHEAT CULTURE.

Nor is the growth of wheat in this country less important than that of Indian corn. In some respects it is even more so. It is the brain-food of the world. It has been said that the progress of civilization and intellectual culture can be traced from one degree to another by the extent of its growth and consumption. It is gratifying, therefore, to find that our present annual production of this cereal amounts to nearly 300,000,000 bushels, and that our ability to increase it is capable of an almost unlimited expansion. It has always entered into our exports to an extent dependent chiefly upon the foreign demand, and experience has proved that the surplus of this grain, the amount we could spare from home consumption, is as elastic as Indian-rubber. If Europe needs our wheat or our flour, and is ready to pay us good prices, either from a short crop, a disturbed state of political affairs, or from any other cause, no one could set bounds to our surplus, because the more she wants the more we have to spare, and the less she requires, the more freely is it used at home. In other words, the amount of exports will be regulated chiefly by the price, and if foreign countries are willing, or are compelled to pay for it, we can supply them to any extent under any ordinary circumstances. The export, for instance, in 1850, amounted to little more than eight millions

and a half, while in 1854 it went up to over twenty-seven millions of bushels.

We have seen that wheat was cultivated, to some extent, by the early settlers of the country. Occasionally, to meet the exigency of a short crop in England, France, Portugal, Spain, or the West Indies, it was exported, to some extent, in the early part of the last century. By the year 1750, New Jersey had come to take the lead of all the Colonies in raising wheat, and may be regarded as at that time the great centre of the wheat-growing region. Its culture had grown to be very considerable along the Hudson and Mohawk, and in Pennsylvania. Maryland, Virginia, and the provinces further south had made tobacco the leading object of culture, almost from the first of their settlement, and this crop constituted for a long time the most important export from the British provinces, though North Carolina had shipped, on an average, about 130,000 barrels of pitch, tar and turpentine, and South Carolina considerable quantities of rice. But the product of tobacco had been diminishing for some years previous to the Revolution, on account of the exhaustion of the soil for that crop, and the planters there had turned their attention, to a greater extent, to the growing of wheat and other grain. They could by law export tobacco only to Great Britain, but they could ship wheat, flour, lumber, &c., to the West Indies and elsewhere. Wheat, therefore, had begun to enter into the exports of the more southern provinces prior to the Revolution.

INCREASE OF PRODUCTION.

But that the production of wheat and flour had not risen to anything like the relative importance which it holds at the present time, will appear from the fact that in 1791 the export of this grain was but 1,018,339 bushels, and 619,681 barrels of flour; while in 1800 it was but 26,853 bushels of wheat and 653,052 barrels of flour. In 1810 the amount sent abroad was 325,024 bushels of wheat and 798,431 barrels of flour. No statistics of the actual production of this grain were gathered previous to the census of 1840, but it is reported in that year to have been 84,823,272 bushels. From that time to 1850 the increase appears to have been but 15

per cent., the product, at the latter date, being 100,485,944. In that year, or rather in 1849, on which the return is based, Pennsylvania produced more than any other State in the Union, or 15,367,691 bushels. Its product at the last census was nearly 20,000,000, but the centre of production has moved farther and farther to the west.

Since the practicability and economy of the reaper and other machinery became certain, the increase in the production of wheat has been more rapid, as appears from the fact that in 1860 the crop amounted to 173,104,924 bushels, and in 1870 to 287,745,626 bushels. Our exports of this cereal in 1860 amounted to about 12,000,000 bushels, in 1861 to over 20,000,000, and in 1862 to very near 30,000,000, a greater quantity than had ever been known before. In addition to the vast increase of this crop in the Middle and Western States, the production of wheat in California now comes in to swell the aggregate capacity of expansion, to an extent worthy of notice; for while in 1850 her product of wheat is returned as only 17,228 bushels, her yield of 1870 was nearly 17,000,000 bushels, with her resources but slightly developed. And when it is considered that the great Northwest,—Iowa, Minnesota, and the region lying beyond them,—still remains, to a large extent, unoccupied, there seems no reason to apprehend that the growth of this important crop will not continue to increase in the future as rapidly as it has in the past.

The other smaller grains have never occupied so prominent a position in our agriculture, being grown more especially for home consumption, but in the aggregate they constitute no mean item of our national agricultural wealth. Thus our rye-crop, as returned in 1870, amounted to nearly 17,000,000 bushels, our barley to nearly 30,000,000, our buckwheat to nearly 10,000,000, and our oats to over 282,000,000. Rice, which in 1860 was reported at 187,167,032 pounds, had fallen off in 1870 to 73,635,021 pounds.

THE POTATO.

The potato is more universally cultivated than any other plant except, perhaps, Indian corn. It is scarcely more than a hundred years since it became universally recognized as an

indispensable farm product. During the latter part of the last century, and the earlier part of the present, its cultivation in new soils was so easy, and its yield so abundant, that it became an important article of food. No account was taken of it in the census, however, till 1840, when the yield was reported as 108,298,060 bushels. Since that time the liability to disease has become so great that the production has not increased in the same ratio as many other crops, though the amount, by the census of 1870, including over 20,000,000 sweet potatoes, was 165,047,297 bushels. It has at times formed no inconsiderable item of export, though by no means to be compared in this respect with wheat and Indian corn. It is largely used in the feeding of stock in some sections of the country.

AN EARLY EXPORT.

The culture of tobacco was undertaken by the settlers in Virginia from the very outset of the colony. It is recorded that in 1615 the gardens, fields, and streets of Jamestown were planted with tobacco. It immediately became not only the great staple crop, but the principal currency of the colony. By the year 1622 the product amounted to 60,000 pounds, and it more than doubled in the next twenty years. The culture of this plant was introduced into the Dutch colony of New York in 1646, though it never gained the prominence there that it did farther south. But Maryland, the Carolinas, Louisiana, and later, Kentucky, made it the leading object of their culture almost from their first settlement. It long constituted the most valuable export of British America; but the product per acre had been diminishing for many years before the Revolution, owing to the difficulty of supplying manure, and the consequent exhaustion of the soil. But from 1744 to 1776 the exports of this crop averaged 40,000,000 pounds a year.

Tobacco has now become a somewhat prominent crop in Massachusetts and Connecticut, and in both of these States its culture is rapidly extending. In 1850, for instance, but 138,246 pounds were raised in Massachusetts; in 1860 the crop increased to 3,233,198 pounds, and in 1870 to 7,312,885, while the crop of 1872 is probably at least 25 per cent. greater

still. The aggregate yield of the country in 1840 was reported by the census of that year as 219,163,319 pounds, while in 1850 it was reduced to 199,752,655 pounds; but in 1860 it went up to 434,209,461 pounds, to fall again in 1870 to 262,735,021 pounds, a fluctuation to be explained in part by the many casualties to which it is liable, as damage by insects, hail, drought, frosts, &c.

THE COTTON SUPPLY.

The cotton crop of the country has grown up entirely within the last hundred years. The first improvements in the process of spinning it in England were not made till the invention of Arkwright, in 1769, and the spinning-jenny of Hargreaves in 1770, and comparatively little cotton had been raised in our Southern States previous to 1793, when Eli Whitney invented the cotton-gin. Up to that time the difficulty of freeing the cotton from the seed had been such that one hand could clean but a pound a day, and even at the high price of 25 or 30 cents a pound it could not be made profitable. By Whitney's invention a hand, instead of one pound, could clean 360 pounds a day. At about the same time steam was introduced as a motive-power in England, and that, with the great improvements in carding and spinning, enabled one man to do the work which it had previously required 2,200 men to do, in the same time, by the old methods.

Machinery had introduced an entirely new condition of things. The effect of it was to produce a vital change in the state of affairs at the South, and the cotton crop very rapidly grew up to immense importance, constituting about a third part of the whole exports of the country. Each decade showed an increase of about 100 per cent. in production, till, in 1840, it had reached 744,000,000 pounds, six times the product of 1820. The quantity of cotton exported in 1792 was only 138,328 pounds. The quantity exported in 1860 was 1,765,115,735 pounds, or 4,412,789 bales of 400 pounds each, but the quantity produced in 1860 was 2,079,230,800 pounds, or 5,198,077 bales. This production had fallen off somewhat in 1870, when the quantity produced was reported as 3,011,996 bales, or 1,204,798,400 pounds.

THE HAY-CROP.

The hay-crop of the country has also grown up almost entirely within the last hundred years, and considering the necessity that exists throughout all the northern portions of our territory for stall-feeding all stock from three to six months of the year, it has an importance there which it cannot have farther south. It has been asserted that the hay-crop, instead of forming a legitimate part of our national agricultural production, and going to swell the aggregate of its money-value, ought rather to be regarded as a tax imposed by the severity of the climate—a tax involving a vast amount of labor and time and money to which the farmer in our milder latitudes is not subjected. There may be some shadow of truth in this view of the case, and yet, like all other apparent hardships, it has its compensations, as the history of the various parts of our country abundantly demonstrates.

There is scarcely anything which a person who has become accustomed to the fine close carpet of green with which nature covers every hill-side and every landscape in our northern sections, would dispense with so reluctantly as the green turf of our natural grasses. But the greatest compensation to be found is the facility which the production of grass and hay gives for keeping up and increasing the fertility of our lands. The system of stall-feeding, for which the making of hay is designed to provide, is the only system by which a constantly improving mixed husbandry can be sustained; and the want of it may be assigned as the true cause of the exhaustion of the lands of Virginia under the constant culture of tobacco. The only substitute for it is the soiling system, and that becomes impracticable of general application in a country where pasturage and browsing are abundant and cheap.

The artificial production of hay is of comparatively modern origin, as I have shown; but within the last quarter of a century it has increased with great rapidity, especially since the introduction of the numerous labor-saving machines has put in our power to cut and cure our grasses so quickly and so cheaply. At the time of the first appearance of this prod-

uct in our national census of 1840, the yield of the entire country was but 10,250,000 tons, and it had increased in 1850 to only 13,838,642 tons. But in 1860 we cut and cured over 19,000,000 tons, while in 1870 the product was stated at 27,316,048 tons, an increase of more than 100 per cent. in twenty years. The money-value of this crop cannot, therefore, be less than $300,000,000, to which is to be added at least an equal amount for the value of grass for summer pasturage, making an aggregate of over $600,000,000 for the grass and hay crop of the country.

That the quality, and consequently the value, of the hay made now has vastly improved over that made a half-century ago, no one at all familiar with the subject can entertain a reasonable doubt. A great amount of thought and experiment has been directed to the best methods of production and of curing, while machinery has given us a greater control over the seasons, or rather has enabled us to avoid the exposure to the exigencies of the weather, to a vastly greater extent than was possible within the memory of men still living.

IMPROVEMENT OF STOCK.

Let us see now what effect this progress has had upon the number and quality of our cattle. There can be no doubt that the idea of the possibility of improving the common stock of the United States was first suggested by the great results obtained by the early improvers of stock in England. The present advanced position of the stock interest of this country can be traced directly to the practical labors of Bakewell, the Messrs. Cully, Colling, Bates and others, just as the first impetus which these distinguished breeders received can be traced to the efforts of such men as Lord Kames, "to improve agriculture by subjecting it to the test of rational principles," and Jethro Tull (1740), the inventor of the horse-hoe, the drill-husbandry, and many other bold and advanced notions. Tull launched out bravely into the field of experimental agriculture, and boldly threw open the door of improvement never again to be closed, and this new-born spirit of progress very soon appeared to spread; for it was only about ten years after him, or about 1750, when Bake-

well began those skilful experiments in breeding and with such marked success as to impress his influence upon the progress of agriculture all over the civilized world.

It was, of course, some years before Bakewell's magnificent results began to attract public notice, even in England, and their influence was much slower in reaching this country. It began to be felt here toward the close of the last century, or more properly, perhaps, directly after the close of the revolutionary war, for Mr. Goff and two other gentlemen of Maryland imported some very large animals from England, in 1783, which appear soon after to have gone into the hands of Matthew Patton of Virginia, who, about the year 1794, removed to Kentucky and carried the cattle with him. A part of the same stock was taken to Ohio in the year 1800 by John Patton, a son of Matthew. These cattle were well known in Kentucky and Ohio, where they soon gained a wide reputation.

There were a few other importations about that period, all of them in small lots, the most important of which were some cattle introduced into Maryland by a Mr. Miller, between 1790 and 1795, and a few Shorthorns into Westchester County, New York, in 1792 and 1796. These were probably the only importations made with any design of improving American cattle. Here and there a Jersey of that day, and possibly a very few individual animals of other breeds, brought over by ship-masters, are known to have been introduced and kept here, but they made no perceptible mark on our common cattle. Nor were there many or frequent importations until after the year 1820, though a herd of Devons, consisting of a bull and six heifers, presented to Robert Patterson of Baltimore, by Mr. Coke, afterwards Earl of Leicester, were imported in 1816; twelve head of Shorthorns arrived in Kentucky in 1817, and two more in 1818. It was in that year the celebrated bull Cœlebs, the founder of Colonel Jaques's "cream-pot breed," Fortunatus, owned by Gorham Parsons of Brighton, and Young Denton, owned by S. Williams of Northborough, were imported into Massachusetts, while Henry Clay introduced the Herefords into Kentucky in the year 1817, and Colonel Saunders's importation of Shorthorns arrived in that State the same year.

Of all these early importations made by public-spirited individuals, the Patton stock probably made the most mark. They did much to teach people the possibility of improvement. They were the pioneers, and, together with subsequent importations, not only infused their blood into the stock of that great Western country, but did something to excite a spirit of emulation among the farmers there, and this may be said to have laid the foundation for the splendid results which Kentucky, Ohio and adjoining States have since realized.

FREQUENT IMPORTATIONS.

After 1820, that is within the last half century, importations became more frequent. But though from time to time all the prominent breeds, the Shorthorns, the Herefords, the Devons, the Ayrshires, and the Jerseys, were introduced on trial, and, to some extent, crossed with our common cattle, the interest in stock was confined chiefly to individuals. The mass of farmers were slow to make changes, especially among the smaller farmers at the East. We may discover the first evidences of some general interest at the West about the year 1834, when the Ohio company for importing English cattle gave a great impetus to the spirit of improvement by large importations of Shorthorns, and from that date the progress in cattle-husbandry became very rapid, and we see the magnificent results of it at the present day.* Early maturity

* The results of these frequent importations and the enterprise they indicated and created in the improvement of stock, may be said to have culminated, so far as the Shorthorns are concerned, in the great sale of the New York Mill's herd on the tenth of September, 1873. Nothing like it has ever been known in the history of any herd of domestic animals in any part of the world. A hundred and eight head of cattle, old and young, brought $380,890, or an average of over $3,500. Eleven cows of the Duchess family of Shorthorns brought $238,650, and a bull of the same family sold for $12,000. Seven head of the Oxford family brought $31,600. A heifer calf, five months old, a Duchess, brought $27,000. The 1st Duchess of Oneida, three years old, brought $30,600, to go to England. The 10th Duchess of Geneva brought $35,000, also to go abroad. The 8th Duchess of Geneva sold for $40,600. Four cows averaged over $33,000 apiece.

The Duchess family of Shorthorns was established by Thomas Bates, a distinguished English breeder, in the early part of the present century. The herd of the celebrated Charles Colling was brought to the hammer in 1810, and Bates, who already had some of the Duchess blood, bought of Colling at private sale, here laid the foundation of what he called the Duchess family. "Comet," an uncommonly finely formed bull, brought at that sale a thousand guineas, the highest price that had ever been paid for such an animal. After breeding with great skill for many years,

and a tendency to fatten well are of transcendent importance to the Western farmer who breeds to supply the stalls in our Eastern markets, and he was quick to see how he could improve the intrinsic qualities of his stock in these respects.

In the Eastern portions of the country the dairy early became the leading object of pursuit. Size and fattening properties were of less account, and hence we find that modern importations for that section have consisted chiefly of the celebrated dairy breeds, of which the Ayrshires and the Jerseys have taken the lead, according to the special object proposed. These importations have been especially numerous within the last twenty years, till they have greatly modified the stock. In Massachusetts, for example, in 1853 there were less than seventy-five pure-bred Jerseys in the whole State. Now they number several thousands, and single herds now contain more pure and high-bred animals of this breed than could have been found in the State twenty years ago. And the same remark applies to the Ayrshires.

While the constant introduction of improved cattle from abroad has effected a very marked general improvement in the quality of our animals, the universal interest in cattle-husbandry has led to greater knowledge of stock, to better systems of feeding and management, and so to more satisfactory results. No longer ago than 1841, Mr. Colman, a well-known agriculturist, remarked that the general treatment of cows at that time, in New England, would not be an inapt subject of presentment by a grand jury. Now they are better sheltered, better fed, and more tenderly treated.

And while this progress in the improvement of the intrin-

this celebrated herd was sold at auction in 1850, after the death of Mr. Bates. At this sale, Col. Morris of New York bought several of the Oxford family, also established by Bates, and forming a part of his herd, and numbers 5, 6, 10, and 13 came to New York, together with the famous bull "Romeo," bought of the Marquis of Exeter, in the same year. In 1853, again, Col. Morris and Mr. Becar bought at Earl Ducie's great sale, Duchess 66 and the Duke of Gloucester. In 1856, Col. Morris, then sole proprietor of these choice animals and their progeny, sold fifty head of them to Samuel Thorne of Westchester County, New York, who had also purchased at Earl Ducie's sale, in 1853, the cows Duchess 59, 64, and 68, and that most perfect of all his kind "Grand Duke," at over a thousand pounds sterling. In 1857, Mr. Thorne sold his whole herd to J. O. Sheldon of Geneva, N. Y., who, after breeding it ten years with great skill, in 1867 sold the herd to Wolcott & Campbell of New York Mills, near Utica, N. Y. Mr. Campbell became sole proprietor of the herd in 1872, to sell again in 1873, with the result stated above.

sic qualities of our stock has been going on, the number of neat-cattle in the country has largely increased. The aggregate number by the census of 1840 was 14,971,586; in 1850 it was 18,378,907; while by the census of 1870 we find 23,820,608. Of these there were about 9,000,000 cows. It will be seen that the amount invested in this class of live-stock alone cannot be less than $300,000,000, the total value of the live-stock of the country being officially reported as $1,525,276,457.

THE DAIRY INTEREST.

It would be interesting to study the form in which the product, or, in other words, the profit of the vast amount of capital invested in neat-stock appears in different parts of the country. Space will admit of only a brief allusion to this point, but it is evident that throughout the Northern and Middle States it will appear very largely in the form of dairy products, while in the West we shall find it more generally in the form of slaughtered animals. Among the dairy products we find by the last census that we sold 235,500,599 gallons of milk in its natural form. It went chiefly to supply our large towns and cities; the figures not representing the vast amount consumed at home, and thus contributing so much to the comforts and the necessities of life. At the same time we produced 514,092,683 pounds of butter and 53,492,153 pounds of cheese. These figures, large as they are, do not represent anything like the production of the country. The value of butter made in New York alone in the year 1865 exceeded $60,000,000. It is probable that the cheese made in factories, now numbering something like fifteen hundred, was returned under some other head, and that the 53,000,000 is the amount supposed to have been made in private dairies, for we know that the quantity of cheese made in New York State in 1864 for sale, in addition to that consumed on the farm, was nearly 72,200,000 pounds, while the product there, as in all the other Northern States, has been rapidly progressing since that date, owing to the constant expansion of the factory system and the stimulus of high prices. It is quite within bounds to say that the butter product of the

country is fully 600,000,000 pounds, and that the cheese exceeds 200,000,000 pounds a year.

The dairy business of this country has developed with such rapidity and to such a degree of importance, with the aid of the highest intelligence and the application of the most consummate skill, as to be regarded as one of the highest triumphs of modern agriculture. Its annual product amounts to over $400,000,000, and the capital invested in it does not fall short of $700,000,000. It gives employment to a vast number of hands, and contributes to the comfort and the health and the wealth of all classes of the community.

THE PACKING BUSINESS.

Another product of the cattle-husbandry of the country, and a most important one, whether considered from a financial point of view merely, or as furnishing a vast amount of food for the sustenance of mankind, is represented in the value of animals slaughtered or sold for slaughter, and by the census of 1870 we find this item amounts to about $400,000,000, or more accurately, $398,956,376, a gain in ten years of very nearly $200,000,000. This, of course, includes the pork-packing business, till recently confined, to a large extent, to certain Western cities, but now carried on as a growing business at many convenient points along our great lines of railway in other parts of the country.

Improvement in swine began less than three-quarters of a century ago. The first that excited any general interest was made by some animals sent from Woburn Abbey, by the Duke of Bedford, to General Washington. The Englishman intrusted with the care of delivering them seized an opportunity to sell them on their arrival in this country, but they were bred and became popular, and from all accounts they were splendid animals, small and fine in the bone, with a deep round barrel, short in the leg, feeding easily, and maturing early. They were long known as the Woburn breed, and in some sections as the Bedford hog, and were originated by a fortunate cross of the Chinese and the large English hog of that day. They would weigh from four to seven hundred pounds at a year old, with light offal and most excellent quality of flesh. They became very common in Maryland, Dela-

ware, and Virginia, and they were sent to Colonel Timothy Pickering of Massachusetts, and became well known in that part of the country. They are now extinct. The Byfield breed, so popular for many years, originated in the same way. China thus did a good thing for our agriculture fifty years ago and more.

Previous to the introduction and diffusion of the Woburn, the Byfield, the Mackay, and more recently the Suffolk, the Berkshire, the Essex, and other popular English breeds, the classes of swine that prevailed in the Eastern and Middle, and especially the Southern and Western States, were coarse, large-boned, long-legged, and unprofitable creatures, better calculated for sub-soilers than for the pork-barrel, though the grass-fed hog had done something to improve them as early as the time of the importation of merino sheep. But it soon became settled that neither the Eastern nor the Middle States could compete with the West in the production of pork upon a large scale, on account of the difference in the cost of grain. The raising and packing of pork has, therefore, grown up very naturally in the Western States, and vast quantities are exported from there every year. At the same time the facilities for carrying on this business have been so greatly multiplied that the whole packing trade has been reduced to a system so perfect that it may almost be said that no particle of the animal is now wasted, that all is economized, either for food or in the form of some commercial product, as bristles, lard, grease, stearine, soap, Prussian blue, etc., the aggregate of which collateral industries is scarcely less important than the preparation of food itself. The business involves a vast amount of capital, gives labor to a vast number of men, and adds amazingly to the material prosperity of the country.

THE WOOL INTEREST.

Sheep husbandry in this country has been subject to great vicissitudes. Sheep were imported by the early settlers, by the Virginia colony, as early as 1609, and they increased by 1648 to three thousand. The Dutch West India Company introduced them about the year 1625, but they proved to be too much of a temptation for dogs and wolves, for it is recorded that in 1643 there were but sixteen in that whole col-

ony. They were kept upon the islands in Boston harbor as early as 1633, and two years after there were ninety-two in the vicinity of Portsmouth, New Hampshire. It became the universal practice in the days of homespun for a farmer to keep a number sufficient to clothe his family.

The old "native" sheep was a coarse, long-legged, and unprofitable animal, and there was no improvement made in the breeding till towards the close of the last century, when, in 1793, the first merinos, or fine-woolled sheep, were imported by William Foster of Boston. They were wholly unappreciated, were given to a gentleman to keep, and he, knowing nothing of their value, "simply ate them," and a few years after was buying the same class of sheep at $1,000 per head. The embargo of 1808 induced many to turn their attention to fine-wool sheep, and soon after very large numbers of merino sheep were imported and distributed throughout the United States, and our modern sheep-husbandry, now grown up to its proportional importance, may be said to date from these importations.

The condition of the country gradually changed, and since the opening of lines of communication to the West, the Eastern States have found it hard to compete in the raising of fine wool with farmers who could furnish us with the raw material for our manufactories at a cost of a cent a pound or less for transportation. The growing of sheep for mutton and for wool has, therefore, been left to a great extent to the Western States and to Texas. We find, accordingly, that of the 28,477,951 reported by the last census, Ohio had about 5,000,000, California 2,768,187, Michigan nearly 2,000,000, and Indiana, Illinois, Missouri and Wisconsin over a million each. The quantity of wool raised exceeded a hundred million of pounds, more than a fifth part of which was raised in Ohio. This was a gain of over forty-seven and a half million pounds over the product of 1850, and of very nearly forty million over that of 1860.

It will thus be seen that the production of wool constitutes no inconsiderable part of our agricultural industry, and that, in this respect, we have made a highly commendable degree of progress. This production, though little enough when compared with what it ought to be in a country so extensive

and populous as ours, is still sufficient to place us in the front rank as compared with other wool-producing countries. And while the quantity has increased, the quality has been greatly improved since the modern interest in breeding began. At the World's Fair in London, in 1851, the fleece that commanded the highest prize for the fineness and beauty of staple, in a free competition with Spain, Saxony, Silesia, and other parts of Germany, was grown on the green pastures of Tennessee, while at the International Exhibition at Hamburg, in 1863, the Vermont merinos carried off the prizes.

AMERICAN HORSES.

Whether the horse in general has actually undergone any improvement or not may admit of some question, but it is certain that the horses of this country have been greatly improved within the present century. The chief means of carrying on our early inland commerce, including a large amount of heavy teaming and transportation, was the horse. The public roads were bad, worse even than they are at the present day, and over these the freight of the country, whatever it was, had to be moved in wagons made to be capable of the hardest usage. The modern light carriage would have been comparatively useless in a new country and over such roads, while a speed now seen every day would have been quite unsafe. The mail contracts, even over a very large part of the country, when the post system was instituted, were based on a speed below four and five miles per hour. But there were no mails previous to 1790; and in 1791, the first year of the mail service, there were but eighty-nine post-offices in the whole country, and less than two thousand miles of post-roads, and on these nine-tenths of the mail-service was done on horseback, the stage service being very small.

A few stage routes had been established at an earlier date. The first, and at that time the only, stage wagon in America is said to have left Boston for Portsmouth in 1661. There were then but six stage coaches in all England. The first line of stages between Boston and New York was started in 1732, a coach leaving each city once a month, and fourteen days being required to complete the journey. A regular stage line between Boston and Gloucester, Mass., was established in 1788,

and consisted of one open two-horse wagon running twice a week. Besides this there were only four stages which ran into Boston at that time.

It will thus be seen that the social conditions of the last century were not favorable to the improvement of the horse, certainly not to increase his speed, now considered indispensable. Fast trotting was scarcely known at the time of the old "Justin Morgan," foaled in 1793, nor was speed estimated as of special money-value till the invention of the modern light buggy and the improvement of roads; but this quality has now come to be essential to the comfort and convenience of all classes of people. In this respect there can be no question that a great increase has been attained by careful breeding, especially within the last thirty years, while much greater attention has been paid to style, action, temper, form, constitution and endurance, so that the aggregate money-value of our horses has been enhanced by the higher general average of intrinsic good qualities.

MORGANS AND BLACKHAWKS.

These improvements are largely due, no doubt, to the frequent importation and infusion of thoroughbred blood into our stock. In some sections of the country, at the South and the Southwest, they may be said to be almost wholly due to this source. But in the New England States, and to no small extent in the Middle and Western States, they are due to the influence of two great classes of horses, both very celebrated roadsters, known as the Morgans and the Blackhawks, the former deriving their origin from the old "Justin Morgan," remarkable for compactness of form, strength and docility, and unsurpassed for general utility; the latter excellent as roadsters, of a high and nervous style of action, wonderfully elastic step, and a symmetrical and muscular form. These two families of horses have added many millions of dollars to the value of the stock of this country. They infused a new spirit into the whole business of horse-breeding, and gave us such a reputation for great success in this direction as to lead Professor Low, of Scotland, in his "History of Domestic Animals," to say of us: "They prefer the trot to the paces more admired in the old continent, and having directed atten-

tion to the conformation which consists with this character, the fastest trotting-horses in the world are to be found in the United States."

But the draught-horse has not been neglected. The Conestoga, a large and heavy breed of horses, used mostly for the purposes of slow work in the drays of our large towns and cities, is extensively raised in some parts of the Middle States, while the Percheron has more recently been introduced and bred in some parts of the West.

The number of horses in this country, according to the last census, was 8,690,219, of which 7,142,849 were on farms, and the balance found in cities and large towns. This was a gain of more than a million in ten years, for, in 1860, the total number was reported as 7,434,688, of which 6,249,174 were upon farms. The number on farms in 1850 was 4,336,719, there having been no effort made to ascertain the number not kept on farms.

It will thus be seen that the capital invested in horses constitutes a large item in our national wealth; and to this should be added more than a million of mules and asses, the number returned in the census of 1870 being 1,125,415. The extent of our dependence upon this class of stock was never more completely realized than during the prevalence of the epizootic of last year, when the infinitely varied transactions of the country, social, manufacturing and commercial, were so nearly brought to a stand-still for the want of the services of the horse.

LIGHT OF INTELLIGENCE.

This brief sketch of the rise and growth of the great agricultural interests of the country, involving such vast amounts of capital, giving employment and bread to myriads of men, and producing annually the incredible income of more than $2,447,538,658, would be incomplete without an allusion to the increase of intelligence, and the part which science has taken in bringing about such magnificent results.

I have already referred to the early attempts at associated effort and the growth of agricultural societies. Few and feeble enough at first, and slow in the growth of their influence among the people, they have now become a powerful aid

in the progress of all departments of agricultural knowledge, and have grown up to a harmonious system of national, state, county and township organizations, all active, not only in gathering and diffusing information, but furnishing a constant stimulus to new effort and to higher triumphs of practical skill.

To the earnest spirit of inquiry which these societies awakened in the community is due, in a great measure, the growth and respectability of the agricultural literature of the country. With the exception of four brief "Essays on Field-Husbandry," by the Rev. Jared Eliot, of Connecticut, the first of which is dated in 1747, I know of no agricultural book, of any account, printed in the colonies previous to the Revolution; and all that followed that event for many years consisted chiefly of the more or less valuable papers submitted to the Massachusetts, the Philadelphia, and the New York societies, till the "American Farmer" was started in Baltimore in 1819. This is believed to have been the first regular strictly agricultural journal published in the United States. Others soon followed, however, till we have now about a hundred periodicals devoted to the various branches of farm economy, some of which are of a very high order of merit. The aggregate regular circulation of these journals cannot be less than three hundred thousand copies, and they indicate a wide-spread desire for information which must necessarily have an important influence on the future development of this great interest.

OUR AGRICULTURAL LITERATURE.

The permanent agricultural literature of the country, now so extensive and so creditable, has grown up, for the most part, within the last twenty years. A few books of a high character appeared, from time to time, forty or fifty years ago, among them Coxe on Fruit-Trees; Thacher's American Orchardist; Arator, by Colonel Taylor, of Virginia; Fessenden's Complete Farmer, Buel's Farmer's Companion, etc.; but a large proportion of the farmer's reading, previous to 1850, consisted of English works, many of which were reprinted in this country. Since that date American treatises, in the highest degree instructive and useful, have appeared, and we have works upon landscape-gardening, fruits, animals,

dairy-farming, drainage, and, in fact, upon subjects covering the whole range of farm economy, many of them of unexceptionable literary merit in point of style, finish and perfection, and the results of accurate scientific research.

To bring the facilities for improvement within the easy reach of the largest number of people, the system of township and district libraries was first initiated by the State of New York, in 1837, with an appropriation of $200,000 a year for three years, and subsequent grants of $50,000. This example was followed by Massachusetts in 1839, and more recently Michigan gave each township the sum of $50 annually for this purpose. Indiana adopted the same policy in 1854, Ohio in 1857, the former appropriating $300,000 a year for two years, the latter $80,000 annually. Illinois and other Western States adopted a similar course, and it was properly regarded as admirably adapted to promote agricultural improvement, as well as the general welfare of the community. At the same time most of the states early adopted the plan of publishing and distributing large numbers of documents upon agriculture, gratuitously, among the people. These documents are, many of them, of high merit, containing the most recent scientific investigations, reports of experiments, and the observations of the most experienced practical men. Probably about two hundred thousand volumes are thus freely distributed through the farming community every year, with the addition of about as many more issued by the Department of Agriculture at Washington. These and various similar instrumentalities, all now in constant activity, are exerting a vast influence in developing our material resources.

WHAT SCIENCE HAS DONE.

The contributions of science to the progress of practical agriculture are by no means small or unimportant. Agricultural chemistry, itself in a state of transition and rapid growth, was never so helpful or so available to the farmer as at the present day. Though Sir Humphry Davy may be said to have opened the door to progress and improvement in this direction, in the early part of the present century, the accumulation of scientific facts was so slow that it was not till

1840 that Liebig announced propositions that opened a new world of thought and study, and awakened the attention of intelligent farmers to the importance of applying the results of chemical investigations, and, in some respects, essentially modified the practice of all civilized countries.

They were simple words to lead to such results:—"To manure an acre of land with forty pounds of bone-dust," said he, "is sufficient to supply three crops of wheat, clover, potatoes, turnips, etc., with phosphates; but the form in which they are restored to the soil does not appear to be a matter of indifference; for the more finely the bones are reduced to powder, and the more intimately they are mixed with the soil, the more easily they are assimilated. The most easy and practical mode of effecting their division is to pour over the bones, in the state of fine powder, half of their weight of sulphuric acid, diluted with three or four parts of water." Simple words, and yet they opened the way to the whole system of concentrated fertilizers, which has extended so far in modern times and grown to such gigantic proportions as to affect the commerce of the whole civilized world.

Guano, to be sure, had first been brought to public notice by Baron Humboldt and by Sir H. Davy, but it was not till the researches set on foot by the revelations of Liebig that it was at all used in England. Twenty casks were landed there in 1840, and so great was the confidence in its use, as a means of renovating the soil and increasing the products of the country, that the importation increased to 2,000 tons in 1841, and to over 200,000 in 1845, the English trade alone employing, in that year, 679 vessels. In less than sixteen years from 1840 the quantity taken from the Chincha Islands alone reached the enormous figure of 2,000,000 tons, and the amount of sales in that time was over $100,000,000.

This precious fertilizer soon came to be extensively used in this country. In 1848, we imported over 1,000 tons; in 1849, over 21,000 tons; in the ten years previous to 1860 the quantity is reported at 842,787 tons. It is stated that in the ten years previous to 1870 the quantity imported was 387,585 tons, valued at about $6,000,000. But these figures give but a feeble idea of the extent to which special and concentrated fertilizers now enter into our agriculture, for many

large superphosphate manufactories now exist in all parts of the country, while a great variety of other special fertilizers are made and offered for sale, some of them no doubt of great value, and others comparatively worthless.

COMMERCIAL FERTILIZERS.

In order to realize how immensely important these fertilizers have become in our modern agriculture, it is necessary to consider that the South is greatly dependent upon them, more dependent than the North, on account of the want of facilities for making and economizing farm-yard manures which the system of stall-feeding implies; but it is also fast getting to be recognized that they must come in as a necessary adjunct to farm-yard manures in high farming everywhere. And hence if the exact statistics could be known, and the extent to which they are used in all parts of the country, the figures would be truly astonishing.

The official inspector of fertilizers in Georgia, for example, estimates that the planters of that State alone pay over $10,000,000 a year for fertilizers, while it is stated, by those in a position to know, that in four months, from December, 1869, to April, 1870, more than 300,000 tons of fertilizers passed through the city of Charleston, South Carolina; that over 100,000 tons passed over the Georgia Central Railway and other points in that State; that over 6,000 tons, valued at $7,000,000, are manufactured at and sent from Chicago, on an average, every year. It is estimated that fully a half million dollars' worth are used in the State of New Hampshire every year. There are many single towns in Massachusetts that use from $25,000 to $45,000 worth, on an average, every year. There are several large fish-guano establishments in Maine, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, and Virginia, one of which is known to make over 7,000 tons a year. These, it is true, are but isolated facts, but they serve to mark the changes which science has already introduced into our practice. A thousand other facts might be mentioned to show what science has done to throw light upon the labors of the farm, and what progress has already been made in studying the composition of soils, of manures, of feeding substances, and of plants,

while investigation and experiment are still being pushed with such vigor as to promise far more profitable and tangible results in the future.

To this end the National Government has come to the aid of the States in the establishment of agricultural colleges where special attention may be given to the various sciences which bear directly or indirectly upon practical agriculture. All the States have now accepted the grant made by Congress in July, 1862, and, in more than half of them, such colleges have been established and are actually in operation, in some form or other. They will undoubtedly do a good work for the rising generation; but whatever results may flow from them, they seem to indicate that the present is but the dawn of a new era—an era of improvements of which we cannot yet form an adequate conception. They show that a greater application of mind to the labors of the hand is to distinguish the future over all past generations, for the large numbers of young men who will go forth every year from these institutions, many of them thoroughly instructed in chemistry and kindred sciences, will give us, at least, the conditions for new discoveries which will open the way to higher triumphs, and so lead on to the golden age of American agriculture.

Afternoon Session.

The Convention met at two o'clock, Col. Stone, of Dedham, in the chair.

The Chairman. It was once my privilege to listen to the somewhat celebrated Josh Billings, and he announced as the subject of his lecture "Milk"; and he introduced himself by turning out a goblet of milk from a pitcher, taking it up and drinking off the top, at the same time saying, that he thought the best portion of milk was the cream. And that was all he had to say on the subject of milk. Although he gave us a long lecture, he never mentioned the word "milk" afterwards. We are to have the milk question before us this afternoon, and I have the satisfaction of believing that we shall hear it ably discussed by a gentleman who will give us the cream of the whole matter, and not only that, but he will give us all the good ingredients of the milk. I have the

pleasure of introducing to your notice the Hon. Harris Lewis, of Herkimer County, New York.

Mr. Lewis. Gentlemen, I can say, in answer to my friend, the President here, that I have had something to do with milk all my life, and yet do not know much about it. I can give you, perhaps, a taste of skim milk; but Josh Billings says the richest thing he ever saw on milk was the cream. I do not know whether I can give you any of the cream or not.

Milk is so well known to every one of you, you have seen so many analyses of milk, you have tasted it so many times, you have seen it so often, that you all know as much about it as I do. Yet there may be some things that have struck me differently in regard to milk from what they may have presented themselves to you, and all I expect to do this afternoon is to present you certain views of milk as I have seen it.

It is enough for me to say, in regard to milk, that it is composed of from 87 to 88 parts water, and the 12 or 13 per cent. remaining consists of butter, of cheese (what we call caseine,) milk, sugar, and earthy matter. It may seem astonishing to us,—it does to me,—that an article of animal food, so largely composed of water, should be of such great value, but He who created milk and created the organs that should produce it, knew precisely its value as an article of food for all the young of that class known as mammals, of which man stands at the head. Milk as an article of food is capable of sustaining man (and I mean woman, too,) from the hour of birth until the hour of death, I care not how far these two periods may be separated from each other by intervening time. It will supply every need of the system, and build up the whole structure. It will, in short, supply every tissue required; and this cannot be said of any other one article of food. Again, milk is the cheapest food known to us to-day. Taken at the price which it brings in the market, there is no animal food that in cheapness compares with it. Again, the cost of its preparation is wiped out; there is no cost in preparing it for food. He who is wiser than all prepared it perfectly. There is no waste, as is the case with other animal substances; no bone, although there is sufficient

bone-forming material. But there is one thing singular to me, and that is, why a people so intelligent as the people of Massachusetts should use less milk than those of any other State in the Union, and why the people of Virginia should use more than those of any other State in the Union. But there is another singular thing connected with milk in Massachusetts that may be off-set against the small quantity used here. The city of Boston is supplied with better milk than any other city in the United States, in proportion to its size. It either speaks well for the milk regulations of the Bostonians, or of the honor of those who supply the milk; which, I will not attempt to say.

The total value of the milk-crop (I may call it a crop) cannot fall short of $500,000,000 annually. Mr. Welles, I know, estimates it at $400,000,000; but, taking the same statistics, as far as I have been able to compare the statistics with the facts, the whole amount is underrated at least one-fifth. In the United States,—in the county of Herkimer, at any rate, and I think it is in a measure true everywhere,—people who are not well posted connect the obtaining of statistics with an increase of taxation, and it is a solemn fact, and a deplorable fact, that we do not get the truth of the matter, as we ought to get it. It may not be so here, and it ought not to be so in any enlightened community, yet I know it is the case in some localities. Then, some of the marshals who obtain the facts in regard to the industry of our country and its wealth, were incompetent to transact the business put into their hands; they were careless, or indifferent, or something else.

I had designed this afternoon to speak more of the taints and odors of milk than anything else, and to point out, if I could, the effect of taints and odors upon keeping milk, and upon keeping the butter which is manufactured from it, and of the effect that these taints and odors have upon its market value; but before going into that subject, I will speak a moment of its specific gravity. We have found, since the introduction of the associated dairy system, under which milk is carried to our butter and cheese factories, and every man is credited with the amount of milk, that is, the number of pounds of milk, delivered, there is great anxiety on the part

of some (and I am sorry it is so), to add to the weight of their milk. Some men do this more out of the spirit of rivalry, emulation, or something else, than they do for the little gain they expect to make from it; but others, I think, go in for the dollars and cents, because we have found, in almost every association in New York, where we have now a great many cheese factories and butter factories, a black sheep in the flock. I would not have you understand, I would not even have you think, that I believe the system of associated dairying has made a single dishonest man in New York. We had, you all know, dishonest ones there before the factory system came into vogue, but it has developed rascality where we little suspected it. Men with whom I would have trusted my pocket-book with the money uncounted, have been detected in wetting up their milk with a little water. I will qualify that by saying, that I would have trusted them with my wallet, not only because of my belief in their honesty, but because of the small quantity of funds it contains. The factory men became alarmed at once. It was a terrible state of affairs, and it looked to us, for a time, as though the whole factory system was going under,—was to be drowned in a few pails of water. Scientific men brought out what was called a lactometer. It is a simple instrument, merely a float. It is in principle a hydrometer, but graduated for the purpose of testing the specific gravity of milk. [Mr. Lewis exhibited one of these instruments.] It is, as you see, a hollow glass tube. It has a stem, graduated, commencing at zero for milk, and ten for water, and is divided into forty equal spaces between the two points, each one of which represents two and one-half per cent. When the factory men had this brought out, they supposed that that was the life-boat in which the factory system would be saved from the inevitable wreck that appeared before them from these milk-and-water men, and our courts not only attempted to establish the specific gravity of milk as a test of its purity (an awful mistake, gentlemen), but the greatest efforts ever made in our supreme court, I think, the efforts made to convict Tweed and some other New York men, were equalled in the county of Herkimer, before the supreme court, to make that instrument tell whether a man stood innocent or guilty of watering his milk.

If that had been done, if the courts of New York had fixed that as the test of the purity of milk, we could have said good-by to the cheese-factory system, because no man would have risked his reputation resting upon something less than a hair. He would have been at the mercy of any man who dropped a lactometer into his milk. The factory men did not see it, and I have spent forty days in attendance upon the courts of New York to defeat it; not because I have any sympathy with the milk-and-water men,—God forbid!—but because I feared it would be established by the supreme court of the State of New York, that the weight of milk determined its value; and I was charged by Judge Mason with being the means by which rogues escaped punishment. But I did not mean to be.

Now, I will speak a little further of the specific gravity of milk. I expected to have had some cream-gauges and per cent. glasses, by which I might have shown those of you who are in the habit of testing milk, how a careful man, at the head of a cheese or butter factory, detects the dilution of milk by water. By a little stretch of the imagination, you can suppose this tin tube, a hollow glass tube, capable of containing just one pint of milk, say up to there. The space of half its length down, is divided into fifty equal parts. Now, we want two of these, and a per cent. glass, and this stands at the door of the cheese-factory, or by the side of every man's mess of milk, as a faithful sentinel. If that indicates that the milk is lighter than it ought to be, there is something supposed to be wrong. If a man puts water into his milk that has any fish in it, we do not need this instrument to create suspicion that the milk has been watered. We have had four cases right around us in Herkimer where a fish has got into milk, and that is very strong presumptive evidence that water went with it! I know, from visiting the beautiful trout-breeding establishment here, that if a man wanted to play the rogue, and wanted to watch all around, look "this way and that way," as Moses did when he slew the Egyptian,—and dip up a pail of water at the same time, if he dipped it out of that trout brook, he would be very likely to dip up a fish. He would be looking to see if anybody else was looking, and would pour the water into the can without noticing the fish. That is just the way the fish get in. One boy in Herkimer

said, "Why pa's cattle run in a lot where there is a brook, and there is a lot of fish in the brook, and the cows drink that water!" If a man's milk is suspected, and we want to test it by the lactometer (which was a misnomer when it was brought out, but is not now, because it is a lactometer now; for we have perfected it, and christened it anew), we get some milk which we know to be pure; and to do that, we want to mix the milk of a whole herd if we can get it. I want to impress this point upon every one—be sure that the sample you get as the standard is pure. Since the factory system came into use in New York State, they have fixed upon a standard for pure milk by common consent, and it is done from the mixed milk of our native herds. You will perceive at once, that if you take a special breed, the milk from special breeds will be of different weights. Some pure breeds give richer milk than others, consequently lighter; some pure bred cattle give poorer milk than others, consequently heavier; but a mixed herd in this country is one of the most thoroughly mixed-up things that you ever saw, and although you may pick out a cow, here and there, from the same herd, where the specific gravity will vary ten per cent., yet I have never tested the milk of a herd, (and I have tested hundreds) that varied one per cent. by the lactometer. That is one of the most singular facts I have ever met, and I can only account for it by the very thorough mixing that our native cows have had.

Now let me go on; I have diverged somewhat. We will take the mixed milk from a herd and put it into one of these cream gauges, filling it up, say to ten; we will leave ten per cent. unfilled (there are not many men who put in more than ten per cent. of water), and we will take the milk that we suspect and fill up the other tube of the same size precisely to the same mark. And we do not care what the specific gravity is. Then we will fill our per cent. glass with water, and set it right in between these two. We will set them so that they will be subject to the same temperature precisely, and subject to the same atmospheric influences. We will let them stand until the cream rises, and then with a spoon made for the purpose, we will dip off the cream. You can read the percentage of the cream. But I would say here, if this suspected milk has a greater percentage of cream

than the milk we know to be pure, we will let the man go. Every patron taking his milk to that factory is his debtor; he is bringing better milk than the others, and was suspected of evil on account of his goodness. It would be cruel to pursue him any further; but we could all of us take that man by the hand and give him a hearty shake, and he would always be able to look us square in the eye. But we will suppose that he does not have more than half as much cream on his milk as there is on the sample which we know to be pure; then, when the cream is taken off, we drop this "little joker" into his cream gauge, and see where it settles, and we note that spot. Then we drop it right into the other. We take this per cent. glass and turn in the water until the lactometer settles at the same point at which it stood in the watered milk. Then we set the per cent. glass upon a level, and we can look across and tell just how large a percentage of water it took to water this pure milk so as to have it precisely like that which had been watered before. In this way we can tell just how large a percentage of water it had. If I have not made this plain to you, say so, and ask any questions that may occur to you.

QUESTION. When pure milk varies from 1000 to 1008 and 1032, how are you going to tell whether that is pure milk or milk and water?

MR. LEWIS. I have not found that variation. The greatest variation that I have been able to find in the whole range of milk is from 1020 to 1044, and when you bring it down to percentages it is a variation of less than 2.4 per cent. in the whole class of milk. It is astonishing that milk is so nearly alike, and yet so different. You feed the young of one class of mammals upon the milk of another, and see how greatly the results will differ, and yet how nearly alike milk is! I would say, that we obtain the specific gravity of milk (most of you will know this better than I) by weighing a cubic foot of it. Now, a cubic foot of water, which is the standard of specific gravity, or the standard by which we compare all others, not only liquids, but solids, is simply this: a cubic foot of pure water, at a temperature of sixty degrees Fahrenheit, when the barometer will stand at thirty inches, will weigh precisely a thousand ounces avoidupois weight. A

cubic foot of milk—that is, the average pure milk of our native herds—under the same circumstances, at the same temperature, will weigh about ten hundred and thirty-one ounces. A cubic foot of cream—and this I hardly know how to venture upon, for Prof. Voelcker says it is heavier than water, but I have found by various instruments (I could not measure its specific gravity with the common lactometer, because it clinks down to the bottom,—pure cream will not float it at all), that cream varies just in proportion to the amount of skim milk you get with it, and some other matter, and that you have to raise it to quite a high temperature in order to get it thin enough to test its specific gravity; but I will venture the opinion that pure cream is nearly as much lighter than water as milk is heavier than water. I know I have Prof. Voelcker against me, but I know this much, that some big men have made some big mistakes. I know that a small man is capable of making a small mistake, and I would refer to President Clark's discoveries, that he brought out so beautifully the other day, to illustrate the fact that some big men have made greater ones. Prof. Voelcker's assertion has cost me more than a week's labor, but I have settled down to this opinion, that cream is almost as much lighter than water as water is lighter than milk. The specific gravity of butter is found to be nine hundred and forty-two ounces, if well worked; and with an ounce of salt added to a pound of butter, it is still considerably lighter than water. Any of you can test this by dropping a bit of butter into a tumbler of water.

So much for specific gravity, and you see from what I have said, that the better the milk the lighter it will be, because the better portion of the whole is the lightest of all. That will be evident to every man.

Now, to test the question in regard to the specific gravity of water, and water and cream, mix some cream in a tumbler of water, (get the purest water you can, dissolve some nice clean ice, that will be as good as any you get unless you get distilled water,) mix them together, and see where you will find your cream and where you will find your water. I have found a variation in the specific gravity of the milk of different cows in my own herd equal to ten per cent., and that

shows the importance of knowing that, in order to select good butter cows and good cheese cows.

I have, perhaps, said all in regard to specific gravity that I need to. Now I wish to speak of some taints that we find in milk. You know that milk comes to us at regular periods, if we milk as we ought to, and in measured quantities. It is not like any other article of food, especially is it not like any other article of animal food. This matter we can control in all other respects, but milk comes to us, as I have said before, in increased quantities at even periods of time, if we milk our cows as we ought to, and treat our cows as they deserve to be treated; and it comes loaded with germs that are capable of destroying it; it is full of germs that are prepared for its own destruction. Now, these putrefactive germs that we find in milk act just according to the conditions in which the milk is placed; we may retard their action, or we may accelerate it. Milk also comes to us with what we call a "cowy odor," or "animal odor," as it is sometimes called. This odor, of course, seems to be stronger and more offensive in hot weather than in cool, and it is more perceptible in a sick cow's milk than in a well cow's milk. Take a cow that is feverish, and it is terrible, it is awful. It smells bad, tastes bad, and it is the very element in milk that makes it unpalatable to most people. There are but few people who can relish new milk as it is drawn from the cow. This animal odor is one of the worst things that we have to contend with in our butter and cheese factories. What it is, I have not yet quite fully decided on for myself. I at first supposed it to be a gas, but I had so much gas about me that it would not agree with me at all, and I concluded it was not a gas. It is something else, gentlemen.

Now, the first thing we ought to do with milk, if we want to keep it a long time, is to rid it of this animal odor. If we want to make it palatable and good, let us get this out. There is a man in New York who has brought out a simple contrivance for doing this. I am sorry he has got it patented. It is simply a tin pail, the bottom of which is perforated with one or two rows of holes. We turn our milk through a strainer, fastened over the top, and it comes out through the holes. It starts in streams, but before it gets down more

than a foot or fifteen inches it is separated into drops and all aired. Well, we all know what a deodorizer pure air is. We depend upon its action upon the blood for every breath we draw. Now, that simple arrangement, inexpensive, easily kept clean, is the best I have ever seen,—and I may say that I have not a cent's interest in it, nor in any other patent right whatever. It is simply a large tin pail, without a bail, the tin turned over, a heavy wire at the top, and that is held in an iron arm, that goes into a standard fastened to the can, suspending it over the centre of the milk-can and the bottom drilled or punched full of holes three-sixteenths of an inch in diameter. The milk, as I have said, starts out in streams and separates into drops before it reaches more than fifteen inches, I should think, below the bottom of the strainer. I say it is the easiest to keep clean, it is the cheapest, the most readily used, and effects the object the most perfectly of anything I ever saw, and I am sorry it is patented. We use forty-gallon cans, all the way of a bigness, for carrying milk, but this can be used anywhere, on any can, by using a tunnel below, if you have too small a mouth to the can.

QUESTION. How high above the can?

MR. LEWIS. You can place it just as high as you please; that is, if your ladder is long enough. When the wind blows you do not want it but a little way above the ground. When the atmosphere is still, or very hot, the higher you get it up the better. I made a good many tests with that a year ago last July, in the hottest weather we had, and I found no difficulty whatever in keeping the milk sweet thirty-six hours.

QUESTION. Where can a man find one of those?

MR. LEWIS. Go to any tinman and get him to punch holes in the bottom of a pail and hang it up.

QUESTION. No patent on that?

MR. LEWIS. There would not be, I think.

QUESTION. Does this take out the animal heat entirely as well as the odor?

MR. LEWIS. Oh, no; it will not cool it below the temperature of the atmosphere, nor quite down to that. I would say that A. P. Bussey of Westernville, Oneida County, is the inventor. I am sorry, as I have said, that he has got a patent, but if I lived here, I would get a tin pail and punch

some holes in the bottom and put it over my can. But I want to caution you against one thing,—never aërate your milk with impure air. I have satisfied myself by my experiments that the animal odor will be got rid of by passing it through this aërator. You can neither taste it nor smell it, it does the work perfectly, but it will only do it for you in a pure atmosphere. If you set your can in a filthy cow stable, where you can hardly breathe yourself, and run the milk through, what would you expect? If you did not smell brimstone, you would smell something worse in the milk. Hence, I want you to be particular, gentlemen, if you aërate your milk, to aërate it with air that is not loaded down with filth. Take some air from which filthy vapors are not rising, take the pure air of heaven, and it is good enough for anybody, or any purpose for which we use it.

Perhaps as short a way as I can tell you how milk keeps under different circumstances would be to relate one of a good many experiments I made five or six years ago. I took from the whole of the milk of my dairy a sample of milk. After stirring it up, I divided that mess of milk into three equal parts by weight, and for the sake of convenience, we will number them as we go along. No. 1 I aërated by exposing it to pure air and cooled it down very slowly to a temperature of fifty-one degrees, and I kept it very near that temperature. No 2 I shut up in a can as tight as this tube would be with the cover on, at the temperature it had when it was drawn from the cow, probably ninety-nine or one hundred degrees; I did not test its temperature, but it could not have been under ninety-eight, I think. It was shut up and exposed to the rays of the sun, just as a milk-can is on the way to the factory or to market. No. 3 I placed in a shallow vessel, and put it by the side of a rapidly decaying animal substance. Now for the result. In forty minutes, by the power of absorption, that milk, No. 3, had taken on a putrefactive ferment, and in thirty minutes after, seventy minutes from the time it was separated from the mass, it was decidedly rotten; it was unfit even for hogs, fit for nothing under the sun, unless it was the manure or compost heap. No. 2, at the end of seven hours, I found in about the same condition that this was at the end of seventy minutes, spoiled,

rotten. No. 1, one hundred and twenty hours after, I found perfectly sweet. Desiring the dish to conduct some other experiments, the cream was taken off, and how much longer it would have kept sweet, I do not know. These three messes of milk were all taken from one; they were consequently all alike when I started. You see that this milk, No. 3, was kept in a temperature of from eighty-eight to ninety-eight, it was somewhere between those two points. I found it was eighty-eight degrees when the work was done.

QUESTION. What was the shape of the vessel in which No. 2 was kept?

Mr. LEWIS. It was just the shape of a tin milk-can.

QUESTION. Was No. 1 of good flavor?

Mr. LEWIS. Yes, sir. The temperature was so low that it had kept perfectly, by freeing it entirely from the animal odor.

QUESTION. Did you use artificial means to keep up the temperature of No. 3?

Mr. LEWIS. No, sir. I used artificial means to keep down the temperature of No. 1. No. 3 I set right in the sun. It was a warm morning. This shows how the same milk keeps under different circumstances and subjected to different influences.

QUESTION. What means did you use to keep down the temperature of No. 1?

Mr. LEWIS. I used ice. I set it over some ice, with a little sawdust between the ice and the milk-pan.

Rev. Mr. TRASK. Allow me to ask if you ever tried your milk in a smoking-room?

Mr. LEWIS. Where I do my smoking, or where meat is smoked?

Mr. TRASK. Where you do your smoking.

Mr. LEWIS. Well, that is assuming considerable. That is assuming that I smoke, and that I have a room to smoke in. For the present I will not acknowledge either.

Now, are there any cheese-factory men here, or any persons interested in cheese-factories? If there are, will they rise up? I want to see if it is worth while to talk to them. [Two gentlemen arose.] There are two. Now, aside from the taints and odors that we find in milk as we draw it from

the cow, there is another class of taints. They get in from putrefactive milk lodged in the corners and seams of pails that are not thoroughly cleansed—that are not cleansed with water at a temperature of two hundred and twelve. I will admit that every taint *may be* killed with a less temperature, that every fungus growth *may be* killed with a little lower temperature, but there is nothing *safe* for us to use but boiling water in our milk-vessels; and I would say to those men who are interested in cheese-factories, or carrying milk to market, if you can buy tin pails, take your wooden milk-pails for swill-pails. A good many folks think that hogs ought to have sour food, and they will furnish it after a while. Buy tin pails, for the reason that you cannot keep wooden pails clean enough, free enough from taint, to use through the hot weather with safety. It is a very simple matter. You all know (or you will if I tell you) that the neater the dairy-woman the sooner she will scour the paint off of your pails; one goes with the other, just as certainly as water goes down hill. If the dairy-maid is neat she will have every bit of the paint scoured off of your pail before the summer is half gone, and it is dangerous to repaint a milk vessel with any of our leads, and then use it right off. The effect of scouring off this paint is simply this: she will scald and scour it, and then stick it on a fence-post or turn it up on a bench in the sun, to dry it during the day. All the seams in the wood will open, and where there are no seams the wood will crack. I have counted over one hundred cracks in an inch, in the bottom of a pail, that would open big enough to take in two milk-spores side by side. You take the pail down and go to milking with those cracks open. As soon as you get your milk in the pail, and it begins to warm up, these cracks close up as tight as a clam, right over the spores, and you have tainted the first milk you have milked. You go on milking, and the next day the process is repeated. Those cracks are open, the putrefactive spores of milk are shut in so close that no woman, however neat, can reach them, because the wood has closed over them; there they are; the same cracks open again, and you introduce these putrefactive milk-spores to the first milk you draw into the pail. Hence, I say, set your wooden pails aside and purchase tin ones, and purchase tin

pails or vessels of any kind that have the fewest seams and the fewest sharp angles, because putrefactive milk will lodge in all those seams and angles, unless boiling-hot water touches them to destroy them.

Those who have been conducting factories know the difficulty of getting milk through the summer to the factory in a perfect condition. Here is one of the starting-points of the evils that we meet at the factory, and an evil that no amount of skill there can overcome. Then there is another class of taints. There are cow-stable taints, gentlemen. The most frequent and inexcusable of all the taints that get into milk are the cow-stable taints. You know we are famed in Herkimer County for making excellent cheese. A man who can get a chance to nibble a Herkimer cheese thinks he has got his tooth in about the right shape for a bite. Well, it is so with our best cheese; but we make cheese in Herkimer County from which a starving mouse would turn with loathing, for the reason that we taint the milk. I will tell you a little story. No one will take exception. If I had the command of the English language that my friend President Clark has, or my friend Dr. Loring, I could give it to you in smooth and polished terms, so that it would offend nobody, but I will have to bring it out in plain English, I guess. There was a man keeping a grocery store (well, it was a sort of variety store) in the village of Frankfort several years ago, who purchased a few cheeses from a man living in the town where I live (Schuyler). I was in the village one day, and this merchant called to me and said, "Lewis, come in here." I went in, and found quite a number there who were discussing something. The merchant says, "I have got some cheese here that I bought of your neighbor," naming him, "and I want to know what is the matter with it. None of us can tell." Says he, "I want you to tell us"—supposing I knew something about cheese. Well, I pretended I did. He cut me off a thin slice, and I took it, rubbed it between my thumb and finger just as you have seen cheese-buyers do (that, you know, was to make them believe I knew something about cheese; I did just as cheese-buyers do). It was rich and salvy, and good to all appearance; but when I smelt it, it had a peculiar smell. I tasted it, and it had a peculiar taste.

"Oh, says I, "I don't eat cheese; let me alone. It is time for me to go." "No," said he, "tell us; you have got to tell us," and they all insisted that I should give my opinion. Well, I told them if they were anxious to have my opinion, it was simply this, that the man who made that cheese didn't put quite milk enough with his cow manure to make good cheese. That is one class of taints that will find the cheese-factory.

Now, I want these factory-men to go with me, hop on a milk-wagon, and go to the cheese-factory. The first thing we will do when we get there will be to look and see if there is any yellow matter appearing in the seams and corners of the vats. If there are none, all right, we will think that the dairy-maid is a pretty good washer of dishes. We will clap our nose to the conductor that conducts the milk from the cans into the vat, and if there is no bad smell there, we will give it up and say that the whole establishment is conducted upon the rules of absolute neatness. If any of you have a close conductor all the way, and it does not smell worse than that cheese in hot weather, why, I will give you this tin case and put that silver hydrometer in with it. If you have close conductors, just go to your tinman, and have him cut out a slice right on top, and then you can clean them. If all the dishes have been kept scrupulously clean and neat, I will give the dairy-maid, or the one who washes the dishes, credit for it. But let us look down under the floor. There is the secret of a great deal of the trouble that factory-men experience. There are cheese-factories located in New York that never will be able to make another pound of first-class cheese until they move the factory from over the bed of filth and rottenness that has accumulated there, or remove the bed of filth and rottenness from under the factory. I have shown by the operation of that specimen of milk, No. 3, how ready milk is to absorb taints and odors. I do not care how much skill the manufacturer has, or how good your milk is when it comes to the factory, unless the establishment is free from putrefactive taints under the floor, these taints will rise by millions and by the hundreds of millions in a night, and they will take possession of your milk, and while the careful, anxious, vigilant cheese-maker is asleep, the work is done, the milk is

ruined. You can no more make a first-class article of butter or cheese from putrefactive milk than you can relish a rotten egg, not a bit. The arrangement of our chees-efactories has been wrong. I visited one in my own county where they had dropped the floor below the sills, laying it upon sleepers that rested upon the ground, for the purpose of getting a descent. They had knocked off a board above the sill, and there was space where the whey might escape. I went in there one day, and walked along over the floor, and the floor had a degree of elasticity that you seldom find in a floor. Wherever I set my foot, with about two hundred pounds avoirdupois, the floor would spring down. It was a beautiful floor to walk on, but I cast my eye as I walked along to the lower end of the room, and I made this discovery: that opposite where I set my foot, for two or three feet ahead and two or three feet back of me, there would something roll out. It was whey, alive with those things that crawl until they fly. What do you call them?

Mr. Hubbard. They come without calling.

Mr. Lewis. Yes, that is so. You fix a pool of filth and rottenness, and they will come without calling; but they will take to themselves wings and fly away. Well, I walked back and forth over this floor, and I says to the factory-man, "what an easy floor this is to walk on; there is a beautiful spring to it," and I would press the boards down as I walked along, watching the effect as I did so; and finally I says to the man, "If those maggots didn't run away, I would." I do not believe that any factory-men in Massachusetts have any such fools about their establishments. There is hardly space big enough to set a factory where the ground is level. I do not think there was more than an inch to a rod of pitch at that factory, and it pitched right under the floor. It was scientifically arranged for the breeding of maggots! I hope the ladies will not take any offence at what I say. My mother was a woman, once. There was nobody in the world that I ever loved as I did my mother, and I speak to you simply in the very language that she taught me. I know that our lady friends, whom I so much admire, will read an article that they will not listen to, and I mean no offence when I speak of these things in terms such as they deserve, perhaps. I wish I had

a better command of the English language, and could smooth these things over, but I cannot.

Now, I want to call the attention of our milk-men here to certain facts. These putrefactive fermenters and all these taints that you introduce into milk, work precisely like yeast. "A little leaven leaveneth the whole lump." A little tainted milk will taint a whole vat full, and your only safety is in ridding your milk of odors and taints such as come in milk, and in keeping out such as are introduced into it; for it is a solemn fact, that milk is carried in the spring and fall to some of our cheese-factories with cow manure mixed with it, in liquid form and in the lump. It comes in quantities by the spoonful, by the gill, by the pint, by the gallon. It is horrible. These taints do not cease their work under the manipulation of the milk at the factory, but they continue their work, and the end, in butter, is rancidity, and in cheese, rottenness. You can neither avoid or evade it; for it is the inevitable result from manufacturing butter and cheese from tainted milk.

An article of food so perishable as milk, should be handled with the greatest care, and by the bestowment of the requisite care to rid it of all impurities, taints, and odors, its value as an article of food may be enhanced one hundred per cent., and its consumption increased to an equal extent. We always determine the value of milk and its products by the last impression left on the organs of taste. If that impression is agreeable as it fades away, we always desire more of it. Our desire for, or aversion to medicine is always determined by the sensation created on the organs of taste; and like milk and its products, if the last impression is agreeable we desire more. If on the other hand the impression made, as the taste fades away, is disagreeable, we do not desire to taste it again. When we find cheese leaving an impression, like that cow-manure cheese I have described, a piece as big as a walnut would supply the Boston market for a year. We limit the demand for milk, for butter, for cheese, by our carelessness; by our indifference. We close the avenues to trade by our own carelessness. If you will make cheese such as every man will desire, and butter that will go below the palate without melting, you will never overstock the market, or overdo

the business, and if you will bring your milk in better condition to the market, the consumption of milk will be increased, the health of everybody who uses it will be improved, life will be prolonged, and happiness diffused by your care and attention in this little particular.

Herod was thought to be an awful man when he sent forth the decree to slay all the babes in Bethlehem two years old and under. He will go down as long as the sacred story is preserved as a fiend, as a cruel monster; but what had Herod to plead in excuse? He, like the Jewish people, believed the prophets, and he believed that a ruler of Israel was born at Bethlehem, who would wrest from him the Judean crown and sceptre, and perhaps destroy his life. He had an excuse for his act; but what excuse have these dairy-men, these milk-venders, these adulterers of milk, who slay more babes every year in every State of this Union than Herod slew at Bethlehem? For the few cents they make by it, they betray the confidence of their customers, and destroy their infants. And what shall we say of that class known as ladies, who live upon the topmost round of the ladder of fashion, who, for the sake of basking in the moonshine of fashion, will cast their own offspring into the hands of irresponsible, ignorant servants for care, depend upon the adulterer of milk for food, and take to their bosom a contemptible poodle puppy? They unite in the crime with the milkman, and share the responsibility of the murder of their offspring. I would it were otherwise. I would feed all this adulterated milk to the puppies; I would feed the milkmen with the puppies that their adulterated milk killed, and I had almost said that it was a pity that these ladies could not have been born female dogs. But I will not say it, Mr. President.

Question. Will the gentleman tell us what is the cause of the poisons which are found in cheese?

Mr. Lewis. They come sometimes from the water the cow drinks, and sometimes from the painted pail.

Question. What do you say about cooling milk.

Mr. Lewis. Never cool it rapidly. Cool it in water, always.

Question. How long will it take?

Mr. Lewis. At least one hour. The more you stir milk

while you cool it, the better, and the more rapidly the gases and odors contained in the milk will escape if you stir it, and they escape more rapidly at a high than a low temperature.

QUESTION. How low should the temperature of milk be to sell?

Mr. LEWIS. If you get it down to sixty degrees and keep it there, it is low enough.

QUESTION. What is your experience in regard to keeping milk in shallow or deep vessels, for the manufacture of butter.

Mr. LEWIS. You get the best cream and make the best butter from deep setting, but the cream will rise in less time through a shallow mess than it will through a deep mess.

Mr. HUBBARD. Which will give the most cream?

Mr. LEWIS. I have not been able to settle that. I have been trying the experiment, and it is so nearly equally balanced, that it wants a good deal of explanation. It varies according to the temperature and the atmospheric influences. I would say that I think milk set deep, if you can control the temperature, will produce the best results. If you cool milk suddenly, you do not free it from the animal odor. There is the danger of cooling it without exposing it to the atmosphere.

The CHAIRMAN. The question is now open to any one who may have anything to say upon this important subject,—a subject of a great deal more importance than I was aware of before the gentleman had gone so thoroughly into it. I await your pleasure. We shall be happy to hear from any gentleman in the audience in continuation of the discussion of this subject. My friend Hubbard here knows all about it. He is a cheese-factory man, and he knows whether he is guilty or not.

Mr. HUBBARD, of Brimfield. I do, not know that I have ever been charged with one kind of adulteration that has been spoken of; as to the other, I can't say. I know this, that there is a difference in cheese; and I know further, that a very small quantity of milk that has been affected in the way of which Mr. Lewis speaks will affect a whole vat of milk. I recollect that in the factory with which I am connected, in the early part of the season, there were one or two days when cheese was manufactured and sent to market which I think must have been in the condition that the gentleman has spoken

of. I never saw but one of the cheeses after they went to market, and that was very rich, soft and buttery, but it had an odor about it that was not pleasant. How it came there I cannot tell. But I am satisfied that what Mr. Lewis has said in regard to milk is true, that it is a difficult thing to have everything in perfect order. I have heard many say that we should never milk our milk into a wooden pail, for the reason that has been given. I have been saying to my friend here (Mr. Rowell) who takes milk to Boston, that I think a wooden stopple is a bad thing to put in a milk-can, for the reason that when it is cleansed and exposed to the sun, the heat opens the chinks in the stopple, and then, when the milk goes into it, the germs to which he has referred, get into the cracks, which close over them and hold them so that they cannot be washed out. Therefore, in the factory with which I am connected, I do not allow any wooden stopples to be used in the cans. The cans are tin, and the stopples are tin, also.

Mr. Lewis has thrown out one suggestion that I think a very good one, and that is, that the syphons which conduct the whey from the vats should be open. It looks very rational to me that they should be constructed in that way, from the fact that it is very difficult to get at them to cleanse them thoroughly, if they are close tubes. I believe that if every precaution is taken with the milk, and everything at the factory is attended to as he has suggested, we may increase the value of our cheese very much indeed. And these suggestions are very valuable to the whole dairying community; not simply to those who are connected with cheese-factories, but to everybody who has anything to do with milk in any way. The susceptibility of milk to odors is well known. I recollect that our friend Mr. Root, of Barre, at our meeting last year, spoke of placing birch branches on the side of his milk-house to shield the milk from the sunshine, and he noticed, as soon as the leaves of those branches were heated, that the milk caught the smell of the wilted leaves. Everything of this kind is suggestive to us, that we need to have, from the time the milk is drawn from the cow until the cheese is in the market, everything in perfect order.

But there is a difficulty with regard to this matter. The milk is brought to the factory from various dairies, and from

somewhere the people have very little knowledge of the proper way to take care of it. And then again, it is many times sent to the factory in just the condition in which Mr. Lewis has described his second sample to have been. I have found that to be true, not only with regard to milk sent to the factory, but also with regard to milk sent to market. Sometimes, farmers are a little behind in getting their milk ready, and instead of the milk having a proper time to cool, it is stopped up tight and goes to the factory or to market in that condition. I have found that if there was any trouble with milk sent to market, if it soured, as it will sometimes, the difficulty was with the night's milk and not with the morning's milk. The milk being sent only once in twenty-four hours, and that at night, if the night's milk was carried to market the same night, there was more difficulty than with the morning's milk, although it was twelve hours older. The reason was this: that the milk did not have time to get properly cooled before it was stopped up tight and kept in that condition until it reached Boston market. I think, therefore, that all interested in our factories, and all interested in the business of sending milk to market, should be sure that the animal heat is expelled from the milk as soon as possible after it is drawn from the cow, and then, if everything is in perfect order at the cheese-factory, and proper care exercised there, we shall have a high grade of cheese, and that cheese will go into the market and sell upon its merits, and not because it is cheese. I must say, so far as the factory with which I am connected is concerned, that we have been successful in the past, in most cases, with our cheese. I do not mean to say, however, that we may not reach a much higher standard.

I wish to say a word with regard to the lactometer. It has seemed to me that that was a very sure test of milk, from the fact, that if we take milk that we know to be pure, and it is so represented by that instrument, and then put in fifty per cent. of water, the lactometer will indicate fifty per cent. of water; if we put in twenty-five per cent. of water, it will indicate twenty-five per cent.; and if we put in ten per cent. of water, it will indicate ten per cent. If it does not tell the truth absolutely, I believe it has done a vast amount of good, because individuals bringing milk to the

factory have noticed that we tested their milk, and if some of us know that it does not tell the absolute truth, the generality of people suppose that it does, and they know that we are looking after them, any way. It has seemed to me that it must indicate the truth, because, if you take pure milk, as I have said, and dilute it, it indicates the per cent. of water put in.

Dr. FISHER, of Fitchburg. If you add one hundred per cent. of water, you cannot tell it by this instrument.

Mr. LEWIS. That is so.

Mr. HUBBARD. I would like to hear from Mr. Rowell, of Boston, who has been in the milk business for a long time.

Mr. ROWELL, of Boston. Ever since I have done any business, I have been a milkman in Boston, and we there are very much afraid of this instrument; we think it is pretty correct in its statements, usually. I know I had a discussion with a friend, at one time, some months ago, when he was at my place, on the subject. At that time I was milking forty cows, and I took forty samples of milk from forty different cows, cooled them off as nearly alike as water from the same trough would cool them, and from those forty samples I did not get half a degree difference. I have tried very many times samples of milk, and I never knew, in a single instance, the lactometer to be half a degree out of the way. Very many times, when I have suspected a dairy, I have been to the place and got a sample of milk, tested it with this instrument, and then taken it to a chemist and had it tested. I tried one sample last week; and I never had a case where the chemist did not tell the same story that the lactometer did.

In regard to the taints and odors of milk, I will say that I came here from Boston to learn something, and if I had gone five hundred miles, I should have been satisfied. After handling milk, and large amounts of it, for twenty years, I have come to the conclusion now that I do not know anything about it. I feel that I have learned more this afternoon than I ever knew before; that is, it has been presented in a more tangible, sensible, straightforward way, so that every one can easily see and comprehend just what is needed.

The fact that milk requires such care and such close atten-

tion, in order to have it good and merchantable in Boston market, has led to a great deal of trouble between the Boston milkmen and the dairy-men who furnish the milk to them. It has led to an immense amount of trouble. Milk comes to Boston through the hot weather in a decayed condition, a good deal of it; it comes tasting bad, rancid. The milkmen say, "This won't suit our customers," and send it back, and the farmer will keep it for a week afterwards, and swear it is sweet. That is where a great deal of this trouble has come from. A man, in order to be a milkman in Boston, must be a thorough judge of the article; must be able to tell by tasting exactly the condition of things, and whether the milk is proper and right to use; and on that fact alone, almost, depends his success as a milkman. If he is a good judge of the article he carries, and has a conscience about it, he can build up a good business. If he is perfectly indifferent to what anybody thinks or says, so long as he conducts his business honestly, he is all right; but if he undertakes to satisfy the men from whom he takes milk, and his customers too, he will not be able to satisfy either, and go down hill very quick.

Mr. EVERETT, of Princeton. I believe there is a gentleman here, living in Westminster, who has one of the best butter dairies there is in this vicinity. We have no cheese-factory, I believe, short of Barre. In my town, we keep butter-making dairies of from two or three to twelve or fifteen cows. The dairy to which I allude is that of Mr. Theodore Wood, of Westminster. His butter has sold for some three cents a pound more in Fitchburg market this summer than any other. He has used the deep-kettle pans this year, and I have been informed that he has made more butter than ever before from the same quantity of milk.

Mr. THEODORE WOOD, of Westminster. I do not pretend to be a public speaker, or to know more about making butter than others. Whatever I do, I try to do as well as I can. Until this year, I have always used ten-quart pans, as is customary. Last winter I was in the northern part of Vermont, where they were using large pans and a good many pails, and last spring I had some pails made nineteen inches deep and ten inches in diameter, with covers having a hole through the top, about an inch in diameter, covered with a strainer.

These I fill with milk and set in a wooden tank in cool water, calculating to keep the milk as near sixty degrees as possible. I think I can get as much cream, or more, in that way, especially in warm weather, than in any other. I do not know that I can make any more butter, but it saves a large amount of work, because you can put twenty-four quarts in a pail instead of using so many pans.

Mr. HUTCHINSON, of Milford. Is there any danger of milk becoming tainted from anything the cows eat or drink?

Prof. STOCKBRIDGE, of Amherst. I say, "Yes." I will assume that the quality of butter, favorable or unfavorable, is derived very largely from the food of the animal. Therefore, June butter, when the cows feed upon the rich, nutritious, luxuriant grasses of that time of the year, is extremely rich and nutty in its flavor. Assuming that, I want to ask this question, Why we cannot, in the winter season, fill our dairy-rooms with the agreeable, nutty odor which the cream itself will take on, and thus give winter butter the flavor, odor and delicacy of summer butter?

Mr. LEWIS. In answer to the last question, I say, "We can." In answer to the first, I say, "Yes." I believe it is possible, by the selection of the right kind of winter food, and by placing roses (which my friend, President White, is very fond of) or anything sweeter, in the room where butter is made, an odor is imparted to the cream. You cannot cook cabbage or turnips in a room where milk is set; it will certainly absorb the odors of the cooked cabbage or cooked turnips. I have placed under the nose of a cow in the stable, onions and garlic, and let them stand for an hour or two, and then I have removed the cow from the influence of that atmosphere for four hours, milked her, and found the odor of garlic and onions in the milk.

QUESTION. How about feeding cows with turnips and cabbages?

Mr. LEWIS. I think if you feed turnips, you will get a turnipy flavor. If you feed them after milking you will get less than if you feed them indiscriminately. I think so; but some deny it; it is an unsettled question. I will say this, however, to those who sell milk to be consumed in our cities. What I have said I have said for the benefit of individuals

as much as for the benefit of factory-men. We ought to lessen the amount of cholera infantum in our cities. I believe that ninety per cent. of the infantile diseases among those children brought up on cow's milk is caused by the adulteration of milk. I take this position, and I take it confidently. I believe it as surely as I believe I am here,—that if I select the milk of a cow to feed to my child, that cow eats for my child, drinks for my child, breathes for my child. If that cow is kept quiet, comfortable and composed, that child enjoys that composure. If that cow is irritated and excited, that child shares the excitement with her.

Mr. Root, of Barre. A few moments ago, when Mr. Hubbard was up, he alluded to myself as having tried the experiment of placing some birch branches near my pans of milk, and said that the odor of the birch leaves was found, when the cream was taken off, to exist in the cream. I must correct the gentlemen there; he was mistaken in the name; it was Mr. Ellsworth. But I will make this further statement in regard to that matter, having a bearing, as it does, upon the question just proposed by Prof. Stockbridge. Mr. Ellsworth apprehended trouble from the presence of the flavor of the birch in the butter, and until the cream was churned and the butter brought into a proper state, his fears were not removed, but then they were; not a particle of the flavor was found cropping out in the butter. He tasted it in the cream, but it all passed off in the process of churning.

One word in reference to turnips, in which I feel an interest. We all know they produce milk. Can they be fed safely? is a question which has been asked and answered a thousand times, and yet, as our friend says, it is an unsettled question. We in Barre uniformly feed turnips up to this time of the year, commencing the last part of September or the first of October, and feeding them as long as our cows remain in milk. That is the uniform practice among all our farmers. I have yet to learn of a farmer who has had any unfortunate results from such a course, and our butter has brought the highest price in the market. But I want to state one other fact,—they are fed immediately after milking the cow. My own theory about the matter is this: That immediately before and during the process of milking, the mam-

mary glands are most active in the secretion of milk; and our Secretary told us, a few years ago, that the secretory glands secrete more milk during the time of milking than any other. Consequently, if you feed your cow a little before milking, or have the mess immediately before her while she is being milked, there is more liability of those odors finding their way through the secretory glands into the milk than if she is fed after milking.

Now I am up, I want to say a word or two on this very interesting subject which we have before us. I want to corroborate what my friend from Boston has said. What is true in regard to the cheese manufacturer is also true in regard to every other man engaged in the production and consumption of milk. We have to be pretty sharp in New England to compete with the folks in the Mohawk Valley. We have got to make an honest article, or we, on these sterile hills, cannot get along and make a decent living and compete with them. Down in Barre we have made up our minds that we have got to exercise our best skill and judgment in everything connected with the manufacture of milk. Therefore, we have adopted a rigid policy with reference to all the milk that comes into our factory, and the result has been satisfactory. Men whose milk has been sent back have not found a word of fault, but have confessed that we were doing them a kindness, because we returned them more money for good milk.

I want to say just one word about this matter of taints; it is of tremendous importance. How are you going to rid your milk of these taints? Our friend has demonstrated the thing very clearly and truthfully, and it operates well, and I hope we shall all use these patent aërators. But I am afraid that somebody will come down upon us, as they have in other cases, and insist upon our paying for them. At the factory which I represent, in the spring of the year, we instituted a most rigid procedure. We suggested this course to a part of the patrons of the factory, that they should bring in their milk at a certain time, and have it made up independently of the milk of other parties. We suggested that that milk, after it had stood for an hour, and had cooled somewhat, and the cream globules began to separate a little, should be all aërated, and we suggested this process: You have got six

cans of milk; take a seventh can and set it in a place where the air will blow briskly; raise up one of the other cans, and pour that milk slowly from this can into that. By doing that, all that milk is aired, the air is carried into the milk; it is aërated to a certain extent. Then we requested them to take their morning's milk (they carry it only once a day) and take the same course with that. This experiment was followed for a certain length of time. That milk, carried in at night from four dairies, making about 1,800 pounds in a day, was taken to the manufactory, placed in the long vat, and skimmed in the morning, and the cheeses were made up separately and kept in the ordinary way. The result was this: that an equal quantity of cheese was produced from that milk that had been skimmed, only you could not get very much cream from milk in the first part of June by that arrangement. It was sent, it is true, to another market from the market to which the other cheese was sent, but it brought a little more a pound than the other. I took different individuals into the factory, where there were three or four sixty-pound cheeses, bored into a cheese, and let them taste it; they pronounced it very fine cheese. Then I took them to the next one, and they said, "I don't see any difference," or perhaps, "I should say this was the best." And so I took them along. In one case, one man said those four cheeses were better than those made of milk from which the cream had been skimmed. It was so, and no mistake; they were better cheeses. More cheese, I claim, was produced from the milk that was cared for in that way than would have been produced from it if cared for in any other way; and I say that milk so prepared is more valuable, keeps longer, produces a better article, and what is better yet, the cheese will, I think, keep longer and retain its best qualities.

It is very difficult to make farmers believe that their milk is not good, and if you do not have uniformly good milk you cannot have uniformly good cheese or butter. The main reason for the difference in cheeses is owing to the difference in the milk. We cannot control all the elements which produce the milk; it is almost impossible. If a thunder-storm comes up just at evening, after we milk, the elements are against us then. In such a case as that, the dairyman should

know that fact, and the man at the factory should know that fact. The dairyman should hasten in with his milk in the morning as early as possible, and the foreman at the factory must handle that milk in a peculiar way to make the best cheese.

QUESTION. What is the effect of setting the night's milk in cans in troughs of water, where it is cooled, and then taking the morning's milk with the animal heat in it, carrying them to the factory together and putting them into the vat together?

Mr. LEWIS. It is not practised in Herkimer.

Mr. ROOT. It is never practised with us. Do I understand you, that the morning's and night's milk are mixed together before they leave the house?

Mr. WETHERELL. No, sir. I wish to be understood. I have stopped with a farmer many a time, and seen him, when he milked his cows at night, put the milk into cans and set them in a trough of deep water. At five o'clock the next morning, he gets up and milks, puts that milk into cans right from the pail, strained, without taking out the animal heat, and carries those cans together to the factory. What I want to ask is, whether it is all poured into the vat together?

Mr. ROOT. That is always done.

Mr. WETHERELL. That is the very point I wish to make. What is the effect upon the quality of the cheese of that treatment of the milk?

Mr. ROOT. There is no unfortunate result from it, if your milk is all good.

Mr. WETHERELL. What says Mr. Lewis?

Mr. LEWIS. I answer in the same way.

Mr. WETHERELL. Not if the animal heat is left in the morning's milk?

Mr. LEWIS. If the animal heat is left in the milk, the milk is not good. I have said that.

Mr. WETHERELL. I have stated that the animal heat is all in it.

Mr. ROOT. I will say this: You all know the Barre cheese. It is uniformly of good quality. I say that up to the present time, it has been the uniform practice to carry the

milk in that way. The farmers do not live a great way from the factory, and it is rapidly taken in.

Mr. LEWIS. Don't they cool the morning's milk?

Mr. ROOT. Never.

Mr. WETHERELL. I will give another fact: A man carries milk four miles under a hot sun, before nine o'clock in the morning, in the summer. He starts with the milk with the animal heat in it, and with the night's milk that has been cooled in the way I have stated. I have often said that, in the first place, the cream that has separated in those cans never can make a part of the cheese. It floats off with the whey; and in the second place, the milk carried there with the animal heat in it, never can make good cheese.

Mr. LEWIS. I would have the milk aërated always, to take the animal heat out.

Mr. ROOT. I said that we adopted this practice, and we have never succeeded before in making a uniform article, every day alike, and it never can be done so well as by aërating the milk. I want to say just one word about this matter of cleansing the cans. The New York State cans are made better than ours. The cans made here are not made quite right. Our tinmen may solder the outside very nicely indeed, and yet inside of the can there may be little crevices where the milk becomes hardened; and, though the cans may be scalded, yet there will be a substance that will gradually collect there, that will hold little particles of ferment, which, unless the most assiduous care is taken, will remain there and injure the milk. One man who was noted for his cleanliness had his milk sent home from the factory on a certain day, because it was sour. He had scalded his can at 212 degrees, and yet there was an odor. He came to me and said, "What shall I do?" It troubled him a great deal; it troubled his wife. Said I, "Go and get some quicklime and put it into your cans; put in boiling water; stop up the covers, and see what that will do." He did it, and has had sweet milk ever since; it killed out every particle of ferment. I said to our foreman, "Take a jack-knife and run it round the edge of the can at the bottom, and then knock out whatever you get, and ask the man to look at it, and if he don't see something there that looks like dirt, I shall be mistaken."

Mr. Lewis. Ask him to smell it.

Mr. Root. Now, all that holds true with regard to cheese-makers, holds true with regard to milkmen.

Mr. Lewis. More so, because they are feeding innocent babies.

Mr. Root. My friends in Boston, I am afraid, are accused wrongfully of selling pretty blue milk. It is natural for cream to separate, and unless you can arrest its progress by doing something to it, it will separate. Now, my suggestion to milkmen applies as well to our patrons at the factory. Take your little cans, after they have been setting about an hour, and pour the milk into another can, and air it, and you at once arrest the separation of these butter globules; and the oftener you do that, the longer these butter globules will be held in the milk in suspension, not separate and rise to the top. That is why I claim that we make more and better cheese by having our milk properly aërated.

Mr. Hubbard. It is against the rules of our factory to allow anybody to bring their milk there until it is cooled. It has been stated as an absolute fact, that milk which is thoroughly cooled will make more cheese and better cheese than milk which is not cooled.

Mr. Root. I don't understand how much that word "cooled" comprehends.

Mr. Hubbard. I can't say to what temperature it is dropped. During this season we have had holes placed in the top of our cans so that the milk is aired all the way to the factory.

Mr. Everett. It would get but a very slight airing in that way.

Dr. Sturtevant, of Framingham. As some remarks have been made upon the subject of mixing the cream with the milk, it seems fitting that I should present the result of some observations I have made. Milk is a white, opaque fluid, and it derives its whiteness and opacity from the presence of innumerable minute white globules which are suspended in it. These globules differ in size in different specimens of milk, and they have different relations in different grades of cows. They affect also the physical relations of milk. If three per-cent. glasses are filled with milk, respectively from the Jer-

sey, the Ayrshire and the Dutch breeds, these specimens of milk will have different reactions, they will show differently from each other. When they are kept at a temperature of about seventy degrees, the Jersey cream will about all come to the surface within four hours, leaving a bluish skimmed milk. The cream in the average Ayrshire milk will take about twelve hours to reach the surface, but the skimmed milk will be white in color; there will be much less difference between the color of the cream and the color of the skimmed milk. The Dutch milk will throw up its cream in about the same time, or a little longer, than the Ayrshire milk, but it will leave a blue skimmed milk. Take these glasses, commencing with the one containing the Jersey milk, and agitate it quite violently, and you will find that the cream will mix with difficulty with the milk; I might say it will not mix at all, after a certain time, but it will not mix with any readiness. Treat the glass containing the Ayrshire milk in the same manner, and it will mix and present the appearance of new milk. It will take considerable agitation, but less by a good deal than the Jersey milk. The Dutch milk, on the contrary, by simply turning the glass over two or three times, gently, will present the appearance of new milk. The cream globules will have united with the milk in apparently the same proportion and the same state as when the cream rose from it. So that when it is said that cream will not again unite with the milk, these experiments of mine, which have been many in number, show that it depends largely upon the grade of the cow.

The explanation of this is a very simple one. The globules of these different kinds of milk differ in size, and differ in the proportions in which the globules of the same size appear in the milk. The Jersey globule is large; the milk contains very few granules. (I call granules, those globules which are under one twenty-seven thousandths of an inch in diameter. Anything which is over that presents, under the microscope, with ordinary light, simply a circle; when the light is thrown upon the side, you will see that it is globular.) The Jersey milk, as I have said, contains very few granules. There is great uniformity in the size of the globules. On account of their greater size and specific gravity, they reach the surface

in a short time; and on account of the evenness of their size and their being so few granules, a smaller proportion of them are left in the skimmed milk, and it therefore shows a blue appearance.

Ayrshire milk, with reference to the globule, can be separated into two divisions. The Ayrshire breed has been tried for many years with reference to making cheese and with reference to making butter, and for both purposes. One breed is a butter cow; she gives a very favorable butter product. One breed is a cheese cow; the per cent. of cream is much less. Therefore if you select the milk from a cow belonging to what I may call the butter branch of the Ayrshire family, the globule is larger than in the milk of that branch of the tribe which has been bred with reference to cheese. But it differs from Jersey milk in containing many granules, many small globules, and very few globules as large as those contained in Jersey milk. In fact, there is a marked difference between the two in the size of the globules, and being smaller, the result is, that the cream rises to the surface less swiftly, and separates from the skimmed milk less completely, leaving a white-colored skimmed milk.

The globules of the milk of the Dutch breed are much smaller than the globules of Ayrshire milk; about as much smaller than the Ayrshire globule as the Ayrshire globule is smaller than the Jersey. In fact, the Ayrshire globule occupies an intermediate position between the Dutch and Jersey breeds. The Dutch globule is more uniform in size than the Ayrshire, and although there are many granules in it, yet there are not so many in it as in the Ayrshire milk. Accordingly, the skimmed milk presents a very blue appearance.

QUESTION. Does Dr. Sturtevant wish it understood that the globules in any one of these three cases are to be regarded as reincorporated with the milk again, as they were originally, or only mixed with the milk?

DR. STURTEVANT. It is always mixed, never incorporated, in the sense of being a different product; but whether they are mixed as completely as in the natural product, I cannot tell. But the eye will detect no difference in those cases where I call them mixed.

Now, there are other relations between these globules and

the products coming from them. These larger globules will churn much more readily than the smaller globules. Those globules of a certain size appear to break at a certain time. By taking a specimen of Jersey milk and churning it in a long bottle, by agitating it simply, and timing the result, and then comparing the time with the size of the globule, I find there is a regular gradation and correspondence between the time it is necessary to keep the cream in the churn, and the size of the globule, when the churning is carried on under similar conditions.

These experiments of mine are only comparative, and they were carried on under the same system. I would place in an ordinary bottle eight or ten ounces of milk, note the time I commenced with the samples and agitate it until the butter appeared; I then would note the time, and churn some minutes longer, until it appeared to be perfectly separated. In fact, I find I can predict, by observing the milk first with the microscope, the time required to churn by this process. A few days ago, I went to one of my neighbors, who has kindly put his herd of Jerseys at my disposal for these experiments, and got a bottle of the milk of his best cow, at the period most favorable to the size of the globules; I examined it under the microscope, and wrote down on a piece of paper, "It will take five minutes for that milk to churn." I took a specimen of Ayrshire milk of the same quantity, examined it, and wrote down, "It will take twenty minutes for that milk to churn." The result was, the butter came in five minutes and a quarter in the Jersey milk, and in nineteen minutes in the Ayrshire milk. That experiment shows that there is a definite relation between the size of the globule and the time required for churning.

I will make one practical application of this discovery of mine, and leave it there. In order to test the question of the effect of the size of the globule upon churning, it occurred to me, that if the milk of two different breeds was mixed, the product of butter would be less from the two samples churned together, than the sum of the two churned separately. I therefore took the usual quantity of Jersey milk and churned it, and churned the same quantity of Ayrshire milk—all under the same circumstances—and added together the result. I

then took an equal quantity of the milk of the two breeds, and churned it together, and I got considerably less product from it.

At the same time, I carried on a system of microscopic observations upon the globules remaining in the buttermilk of the two separate and the two together. I found that where I churned, I churned in each case globules up to a certain size, and if I carried on the churning long enough to separate the smaller size, I simply over-churned the larger sized globules and brought them into a liquid condition. In fact, if I took out the buttermilk and churned it over again, I found that upon standing, it would throw up a layer, not of cream, but of oil. Over-churning seems to change the condition of the butter, and bring it into oil.

I am very sorry that I cannot prove these statements to you by figures, but it would be impossible for me to bring before you the figures upon which these conclusions are based. These few results which I have given you are based upon measurements of over eight thousand globules, made during the last few months, and the experiments have been very numerous. And this is only one aspect of the case.

In regard to the globules of the milk of the native cows, I will say, that the globule takes on the type of the breed to which they are most nearly allied. I have not carried on the experiments with the milk of native cows long enough to be able to state positively, but I do not believe you will find any definite size for the globule of the native milk.

Mr. Carr. Mr. Lewis does not seem to be very favorable to turnips. I wish to ask him what he feeds for roots.

Mr. Lewis. Mangold-wurzels. Now, for fear that I may have left a wrong impression upon the mind of any one present, I would say, that the lactometer alone is no test of the purity of milk. That is what I labored to establish in the courts of New York, and incurred the reproach of Judge Mason, as standing between the criminal and due punishment for his crime. There are many ways in which milk may be adulterated, to bring the water with which it is adulterated to the exact specific gravity of milk. This trade is too well known now, and you will excuse me if I do not tell you any way in which it may be done, for I am satisfied that some

milk-dealers commence in the business honorable, honest men, but they fall into bad habits,—you know we are swayed by habit and custom; we do not know to what extent our associations influence us,—and they presume upon the confidence of their customers, until their presumption, at some unguarded moment, will turn water into their milk. Why, there is nothing more dangerous than presumption. Samson presumed upon his strength, and pulled the tower upon his head. Solomon presumed upon his wisdom, and became a fool, in some respects. Bonaparte presumed upon his military prowess, and died upon St. Helena. Tweed and Fisk presumed upon the money they had stolen from others, and one died, and the other, when charged with his stealings, straightened himself up and said, "What are you going to do about it?" And a man may presume upon his honesty until he becomes a rogue in the milk business as well as in the superphosphate business.

Adjourned to seven and a half o'clock.

Evening Session.

THE IMPORTANCE, PROGRESS AND INFLUENCE OF RURAL PURSUITS.

BY HON. MARSHALL P. WILDER.

Mr. Chairman, Ladies and Gentlemen:—I have accepted the invitation to address you this evening, not from the expectation of communicating much that is new, and even at the risk of repeating some thoughts that I may have uttered on other occasions. But having been intimately associated with this Board at its organization, and honored for so many years with a voice in its councils, I could not decline any service which it might be in my power to render.

I have selected for the theme of my subject of this evening, the *importance, progress and influence of rural pursuits.*

I had not the pleasure to hear the lecture of Secretary Flint, and I fear I may travel over some of the ground which he has so ably surveyed.

To enforce the *importance* of rural pursuits before this enlightened audience, or to illustrate by an extended eulogium

their benign influences in promoting the welfare of mankind, were almost like an attempt to prove that the sun imparts light and heat; that his radiant beams cause the seed to germinate, the leaf to unfold, and the harvest to ripen. But as it is by line upon line and precept upon precept that we treasure up the lessons of experience, so let us again this evening contemplate the importance of agriculture, the value and progress of science as applied to this and other arts, and the happy and refining influences which flow from rural life. "Agriculture," said Washington, and it cannot be too often repeated, "is the most healthful, the most useful, and most honorable employment of man." "In the science of agriculture," said the late Dr. Hitchcock, "is involved a great principle which reaches through indefinite generations, and forms the basis of all possible improvement, and the highest hopes of our race." Agriculture was the first employment, and has ever been the most important given to man. Before the furnace had melted the ore, or the anvil had forged the ax, before the woodman had felled a tree or built a hut, before the waters had propelled a wheel or the white-winged messenger of commerce had spread its sails, "God planted a garden in Eden," and commanded man "to dress and keep it." And when by his disobedience he was sent forth as a wanderer in the earth, "to till the ground from whence he was *taken*," he carried with him the Divine decree, "in the sweat of thy face shalt thou eat bread until thou return unto the ground." Such were the absolute commands, and such the primary conditions upon which must ever depend the sustenance of the whole human family. Yes, my friends, blot out the productions of the earth for a single month, and our race would become extinct. "To till the ground from whence thou wert taken," as a means of subsistence, and "to eat bread in the sweat of thy face," were the merciful mandates which have echoed in the ears of all past generations, and which will continue to reverberate through the ages of all coming time. This universal demand for daily bread must be satisfied with the rising of every sun, or the pulse of life would cease to beat.

"This cry, with never ceasing sound,
Circles creation's ample round."

On former occasions I have alluded to the astounding results which have been developed by the progress of science and civilization during the present century. In no previous age have the energies of the world been so concentrated in efforts to economize time, increase power, multiply the comforts and elevate the condition of mankind. The adventurous spirit of modern times has brought forth discoveries and inventions equally remarkable in all the departments of life. No project is too great, no enterprise too grand for the spirit of the age. How remarkable the scale of development! How wonderful the genius of man! How sublime the conquest of mind!

Before entering more fully into the subject of which I am to speak this evening, let us for a moment contemplate some of the events which have transpired in our own age. Many are now living who can remember the time when not a loom was propelled by water, not an engine driven by steam, not an iron rail or a telegraph wire, not a reaper or mower, in all our broad land. Some here remember the time when there was not a steam-engine in all New England, not a pound of anthracite coal used for fire or furnace, not a steamboat traversing the waters of this continent. It is only about eighty-five years since John Fitch, of Philadelphia, first applied steam to his boat, the "Perseverance," on the Delaware River,—the first attempt in America to use steam for navigation, predicting with the foresight of a prophet, as he did in his letter to Benjamin Franklin, that the power of this agent would ultimately navigate the rivers, lakes and oceans of the world.

How marvellous the power developed by steam! Man places a ton of coal in an improved Corliss engine, and it produces for industry the labor which requires three hundred and sixty-five days of a strong man; and it is stated on authority, that the power developed by coal imported into Massachusetts accomplishes more for industry than could be done if all the forty millions of men, women and children of the United States should devote themselves to manual labor, and that the machinery moved by coal in Great Britain, equals the man-power of all the inhabitants of the globe. Suppress the use of steam, this modern motive-power which moves the machinery of the

world, and it would consign the better half of all its industries to the grave; annihilate this almost omnipotent force, and the shades of night would shroud with an eternal eclipse half of the glories of modern civilization. But what shall we say of the printing-press, that tremendous agent for good or evil,—the press which in the days of our Franklin could only produce with wearisome toil a few hundred newspapers per day, when compared with the mighty steam-press, throwing off with almost the velocity of light, hundreds of thousands in a day, and scattering them like leaves of the forest at almost every hamlet in our land. Nor can I fail to allude, in this connection, to some of the astonishing improvements which have taken place in the present century, in the manufacture of textile fabrics, for which this county of Middlesex is so justly renowned. The old spinning-wheels and hand-looms of our youthful days, working with toil and treadle to produce a few yards of cloth per day, have been supplanted by the magnificent machinery of gigantic mills, like those of Lowell and Lawrence, turning out their miles of cloth per day, and rivalling in power, production and competition the manufacturing cities of the Old World.

Human pursuits are so intimately connected with each other, that an improvement in one tends to the advancement of them all. Hence the *rural* arts have been equally benefited with other callings by the discoveries of science, and the application of skill. How wonderful the improvements in labor-saving machines as applied to the arts of husbandry! Some of us remember following the old wooden plough. This has been exchanged for the model iron and steel plough, suited to hill and dale, and to all soils and situations; and, still more strange, for the steam-plough, rolling over its numerous furrows at once, and performing the work of days in an hour, and ere long to become the great engine for the West. The old scythe and sickle of our fathers, hanging, like harps upon the willows, have given place to the improved mowers and reapers, sweeping down their ten acres per day, or to the great Western harvester, moving over the broad prairie like a triumphal car, cutting, gathering and storing twenty acres per day. The old noisy flail, pummelling out only a few bushels per day, has yielded to the mighty

thresher, travelling from field to field, shelling, cleaning and running into bags hundreds of bushels of grain per day. But I must not prolong this train of thought, nor can I even enumerate the multitude of labor-saving implements which the genius of man has invented for the relief of toil in our own time.

I must not, however, omit to mention the great improvement which has taken place in our horses, cattle, sheep and swine; in their classification, adaptation to various soils, markets, and uses.

It is less than eighty years since the introduction of the Shorthorn breed of cattle. Now, witness the fine herds of Mr. Whitman and others. To such perfection has the Duchess strain been bred, that at a sale lately made in the State of New York, one cow, the Duchess of Geneva, brought forty thousand dollars, her calf of five months twenty-seven thousand dollars, the whole herd of one hundred and eight animals realizing three hundred and fifty thousand dollars, or over three thousand dollars per head. Witness, also, the improvement which has taken place in other breeds, in the same or a less period of time; in the Ayrshires, as seen in the splendid herds of Birnie, Sturtevant, Miles, and others; in the Jerseys of Burnett (carrying off all the prizes at the late New York Exhibition), Bowditch, and Adams of a hundred head. The fine Kerrys of Mr. Grinnell, of Greenfield, and last though least in size, the beautiful Brittanies, imported by our Secretary Flint, so useful for small families and limited grounds. Similar advances have taken place in the improvement of other animals, especially the horse, as in the studs of General Russell, David Nevins, Joseph H. Billings, and others, some of which, for stock purposes, corresponding with the highest prices for cattle.

Nor should I forget to allude to the vast area of our cereal crops, rightly termed the exhaustless granary of the world, and upon which the nations of Europe are mainly dependent to make up the deficiency of their crops, England demanding a hundred million and France fifty million bushels for the present year. How would our Pilgrim Fathers have rejoiced, when rendering special thanks to the God of harvests for their annual crop of twenty bushels of corn, six bushels of

oats and pease, could they, with prophetic eye, have seen the thousand million of bushels in our annual crop, a crop of grain sufficient to give a bushel each to every man, woman and child on the face of the globe. Nor would I omit to mention the mountainous piles of cotton, without which for a single year, the commercial world would be stricken with dismay. Why, it is not a hundred years since the first five bales of cotton exported to Liverpool were seized as a contraband article in the belief that no such product as cotton could be grown on American soil, a product that now reaches the wondrous amount of sixteen hundred millions of pounds, and produces an income of three hundred millions of dollars annually.

And have you ever, my friends, duly considered the advantages and privileges which exist at the present day as compared with olden times? It is only about ninety years since the first agricultural society was established on this continent. Your own Middlesex Society, one of the oldest in the State, dates back to only 1794. It is only about twenty years since this Board of Agriculture, one of the first in this country, was formed. It is only about twenty years since the first Agricultural College of our Union was formed. Now, the majority of our States have colleges and Boards of agriculture. And so numerous have agricultural, horticultural and kindred institutions become, that they may be counted by the thousand. Let me also mention in this connection, the knowledge which has been acquired in the arts of hybridization and cross-fertilization, by which numerous and valuable varieties of grains, vegetables, fruits and flowers have been produced. Within our own recollection, the process was but imperfectly known or practised. Now, to such perfection has this art arrived, that every year produces new and superior sorts, which are alike renowned for excellence in the best European catalogues.

Let me also allude to the amazing progress of fruit culture during the last half of this century. In this pursuit, Massachusetts has been a pioneer and leader, and from whence emanated, primarily, much of the enterprise which has spread throughout our land. Fifty years ago the list of fruits was limited to a very few varieties, which were mostly confined to

the gardens and orchards of the opulent and wealthy. Then, with a few exceptions, the fruits were of a common or ordinary quality. Now, we have collections of the apple and pear consisting of hundreds of varieties, many of which possess all the characteristics of a first-rate fruit, and instead of here and there an orchard on the Atlantic and a few varieties for the summer season, we now have thousands of orchards and gardens with fruits adapted to every section of our country, and fruit for almost every month in the year. Then, the cultivation of the grape had received scarcely any attention, except its culture under glass. It is not fifty years since the Isabella and Catawba were brought to notice. Now, we have numerous varieties raised from seed, and hundreds of vineyards scattered all over our land. And so great have been the improvements in packing, and the facilities of transportation, that our markets are supplied with this delicious fruit, even to the winter months. Nor is this all: the juice of the grape, the manufacture of wine, has not only become an article of commerce, but rivals in quality, and finds a market in, the old wine countries of Europe. What would Mr. Longworth, of Cincinnati, the great pioneer in American wine culture, have said, when planting the cuttings of the Catawba and Isabella grapes in 1829, if he could have foreseen that the cultivation of the grape would at this time have been extended through twenty-five degrees of latitude, and from ocean to ocean; that European varieties, without the aid of glass, would be grown in California with as much ease as in the most favored portions of the globe; that the grape would be as common in our markets as the apple, and sometimes sold almost at as low a price; that the products of wine would exceed ten millions of gallons annually; that a sale of champagne wine to the amount of forty thousand dollars should be made for exportation to the wine regions of Europe; and still more remarkable, that this wine, the Great Western, of the Pleasant Valley Wine Company, should bear off, triumphantly, a first prize for champagne wines, at the World's Great Exhibition in Vienna the present year.

Nor is this progress more wonderful than the improvement and advancement which has taken place in the cultivation of our small fruits. Then, with the exception of two or three

varieties of the strawberry, raspberry, and the blackberry, we were confined to the wild species of the hedge-row and the field. It is but about forty years since Mr. Hovey, of Cambridge, raised the first American variety of the strawberry from seed. Now, numerous local varieties, adapted to all sections, make their appearance every year, and so universal has this fruit become as an article for general use, and so great the improvement in packing and the facilities for interchange of products, that our Northern markets are supplied, instead of a few weeks, as formerly, with this delicious fruit, from May to August. So extensive has its cultivation become, that from single railroad stations in several of our States have been dispatched a thousand or more bushels per day for market. In districts where no attention had been given to the cultivation of this fruit twenty years ago, millions of baskets are sold in addition to what is consumed at home.

Nor can we omit the peach, of which such astonishing quantities are sent to the market daily from the Southern, Western and Middle States, especially to New York city, which receives on some days from the various railroads and steamboats an aggregate of about a hundred thousand bushels, and all this in addition to the immense quantities canned and distributed to all portions of the globe.

When I reflect upon the rapid progress of American Pomology in my own day, and its salutary influence on the health and happiness of mankind, the more grateful am I to those benevolent men who opened the way for this new era which distinguishes the fruit culture of our country. How grateful to the feelings of all who have worked with us in this progress, is the prospect which opens to us in the great future of our country! How would Governor Winthrop have rejoiced, when planting his pippin on our harbor island; Peregrine White, when planting his apple-tree at Plymouth; William Blackstone, when planting his orchard on Boston Common; Governor Endicott, when planting his pear-tree, which still survives, at Salem, could they have foreseen the influence of their example multiplied into the thousands of orchards, and the millions upon millions of fruits which are produced in our country! And how would the pioneers of the Massachusetts Horticultural Society have exulted, could they have

had a vision of the unrivalled exhibitions made at its annual shows, and especially at the late national display in Boston by the American Pomological Society, rivalling in variety, extent and excellence, it is believed, any which has been made by other nations,—where States which had not cultivated a fruit-tree sixteen years ago, received the highest prize for apples!

One of the most gratifying evidences of progress and refinement, is the general love and appreciation of fruits and flowers. These have been too often considered as the mere superfluities of life, but the more we are brought into communion with them, the more shall we realize those pure and refined sensations which inspire the soul with love and devotion to Him who clothes the fields with a radiance, to which Solomon in all his glory could only aspire.

The cultivation of the garden, the ornamental planting of our grounds, and the general use of flowers afford striking proof of the high state of civilization which marks the progress of the present age. Within our own recollection the use of flowers at funerals was deemed improper, nor was their appearance in the sanctuary greeted with pleasure. They were thought to be inconsistent with the proprieties of divine worship, as diverting the mind, and detracting from the solemnities of the occasion. God was not seen in flowers, in the rose, or the lily of the valley. From the lovely forms and various hues of flowers, the glories and joys of the garden, the royal psalmist has derived some of the highest types of inspiration, the artist some of his finest conceptions of grace and beauty. We cannot therefore too highly or gratefully appreciate that divine wisdom and benevolence which has surrounded us with these manifestations of His perfection and glory, these beautiful creations,—

"*Mingled and made by love, to one great end.*"

How delightful is the pleasure of communing with those lovely objects nourished and cherished by your own care, and which you almost imagine to be susceptible to your sympathy and love! "The garden," said Lord Bacon, "is the purest of human pleasures; it is the greatest refreshment to the

spirit of man; without which, buildings and palaces are but gross handiworks; and a man shall ever see, that, when ages grow to civility and elegancy, men come to *build* stately, sooner than to *garden* finely; as if gardening were the greater perfection." "Nothing" said the immortal Webster, "is too polished to see its beauty, nothing too refined to be capable of its enjoyment." So thought the king of Israel when he made for himself gardens and orchards. So thought the noble Scipio when he retired to his favorite retreat after he had made Rome the mistress of the world. So thought our own Pickering, Lowell, Dearborn, and thousands of others in our own time, who have retired from the busy haunts of the city to the quiet scenes of rural life, that they might enjoy the rich gifts of bounteous nature, and drink from those pure fountains of contentment and peace. And may I not add what experience has taught me of the sacred influences of rural life to soothe and comfort in those hours of depression, sickness and sorrow, from which none are exempt. Here, then, amidst fruits and flowers, and scenes of rural bliss, let my remaining days be passed, and at last, like fruit fully ripe, dropping softly on the bosom of mother earth, let me lie down to rest in the joyous hope of a glorious immortality in the garden of the Lord, where the tree of life beareth fruit every month, where blight, disease, and the wintry blast of death shall never come, where the summer of glory and perfection shall forever reign.

Some of the most touching and beautiful, some of the most sacred and sublime inspirations of Scripture have been drawn from scenes in the garden. Nor has the imagination of the poet, philosopher, or psalmist, ever conceived of any spot more chastening, more refining or more hallowed in its influence.

> "Though in heaven the trees
> Of life, ambrosial fruitage bear, and vines
> Yield nectar; though from off the boughs, each morn
> We brush mellifluous dews; yet God hath here
> Varied his bounty so with new delights,
> As may compare with heaven."

In no department of cultivation is improvement of taste to be more distinctly seen, than in the decoration of our grounds and the universal love of trees and plants. Many in this

assembly can remember the time when there were but few greenhouses in New England, and these were almost entirely confined to our retired and wealthy citizens. Now, these plant-structures are to be seen in almost all our populous towns and villages, and so much has the taste and demand for plants and flowers increased, that many are devoted to special culture of the rose, the violet, or some other plant. Nor is this taste confined to the rich or middling class. Now, almost every dwelling has its grape-vine or fruit-tree, its woodbine, scarlet-runner or morning glory. Even window-gardening has become a science, and few are so poor whose home may not be lit up with the cheering influence of a plant or flower, whose windows may not become more hallowed by the sweet influences of nature's bloom, than by the gaudy pageant-pane which perpetuates the name of a saint,—perhaps a sinner too. And I confess my heart has often been touched with tenderness and sympathy when I have seen the poor laborer, after a hard day's work, carrying under his arm a rose or geranium to cheer and solace the wife and weans at home. These are the outer manifestations of the soul for that fairer and better clime where flowers shall never fade, the secret yearnings for that paradise beyond the skies which shall never be lost again.

I have spoken freely of the chastening influence of rural pursuits; but before I close, allow me to allude again to flowers; to those symbols of all that is pure, lovely and beautiful,—those golden stars, that like the dew-drops of morning, sparkle on the bosom of mother earth. Flowers are the very embodiment of beauty; flowers are like angel spirits ministering to the finest sensibilities of our nature, often inspiring us with thoughts, which, like the unexpressed prayer, lie too deep for utterance. God speaks by flowers and plants and trees, as well as by the lips of his prophets and priests. So felt Bacon, who desired always to have flowers before him when exploring the mysteries of that divine philosophy which has made his name immortal. Flowers have a language, and like the starry firmament above, proclaim His handiwork and glory. God has imprinted a language on every leaf that flutters in the breeze, on every flower that unfolds its virgin bosom to the sun, teaching us the great lesson of his wisdom,

perfection and glory. How beautifully does the English bard express this sentiment,—

> "Your voiceless lips, O flowers, are living preachers;
> Each cup a pulpit, and each leaf a book."

Who would not listen to their teachings! How intimately do they enter into our joys and affections! Who would not live with them forever! With what tenderness and affection does Milton describe the sorrow of our mother Eve when bidding farewell to her flowers in Eden,—

> "O flowers
> That never will in other climate grow,
> My early visitation, and my last
> At even, which I bred up with tender hand
> From the first opening bud, and gave ye names,
> Who now shall rear ye to the sun, or rank
> Your tribes, and water from the ambrosial fount?"

And here let me recognize the refining and chastening influence of woman, which so signally characterizes the progress of civilization, and the finer arts of modern times. This is especially to be seen in her interest for the cultivation of fruits and flowers, and the adornment of "sweet, sweet home." It is but a few years since woman was permitted to grace the festive board of our agricultural and horticultural exhibitions. Now, no occasion of this kind is deemed complete without her presence. Formerly our tables were surrounded only with the stalks of humanity; now they are adorned with the flowers of female loveliness, not "born to blush unseen." Nor is this all; she is now among our most successful cultivators, training with tenderness and care plants as delicate as her own person. Welcome woman, then, we say, to these festal occasions, to the grounds we cultivate, to our gardens and greenhouses, to all the beauties of nature and the pleasures of art, and to a paradise regained on earth.

Another strong evidence of the progress of refined taste and culture is seen in the establishment of our cemeteries, and the improvement of our burying-grounds. These once neglected and gloomy resting-places of the dead, casting terror and horror on the minds of children and youth, are fast giving way to the shady retreats and sylvan scenes of the wood and forest. Where formerly decaying grass, tangled

weeds, and moss-covered tablets were generally to be seen, now may be witnessed beautiful sites, natural scenery and embellished lots, which awaken sensations that no language can describe, where the meandering path wends you to the spot in which rest the remains of the loved and lost of earth, where the rustling pine mournfully sighs in the passing breeze, the willow weeps in responsive grief, and where the verdurous evergreen, breathing in perennial life, is a fit emblem of those celestial fields, where the leaf shall never wither, the flower never fade, and fruition never end.

I have thus spoken to you, my friends, in a manner which I hope may not be considered as inappropriate or irrelevant to the mission of this Board. My object has been to record some of the important events which mark the progress of our age,—to illustrate the advantages which flow from scientific knowledge as connected with the genius and enterprise of man,—to awaken and excite a love for rural life and rural pursuits, and to show that the present is an advance on the past in all that pertains to a higher state of civilization and the welfare of our race.

And now, in conclusion, let me say, I know of no better temporal acquisition than a happy rural home,—a home where you may sit amid the fruiting of your trees and the blooming of your plants,—a home embellished by your own taste, and endeared by pleasures shared in common with the loved ones of your family—a happy country home, with trees and fruits and flowers, where you may find enjoyment, not in hungry greed for gold, not in the conflicts for political distinction, not in the strife for place, power or renown. For more than fifty years I have trod the crowded marts of trade and commerce. I have shared in the privileges and perplexities of public service, and I have enjoyed the soul-reviving sympathy of family and friends, but I have never forgotten my first love for rural life. Oh, no; whenever I could rescue a little time from the cares of business,—whether at rosy morn, golden noon or declining day, I have fled to the garden and greenhouse, to my favorite trees and plants, that I might commune and coöperate with nature in her secret laboratory of wonder-working power. This is my idea of a happy, rural home; and this my idea of a happy man,—he who is contented with

fruits and flowers reared by his own care, with congenial friends, and a good conscience towards God and his fellow-men. And it has ever appeared to me that contentment and happiness were easily to be acquired by all who really love the cultivation of these lovely objects. And let me add, that I know of no more grateful, and I was about to say, devotional feelings, than those which we enjoy at the close of a quiet Sabbath summer day, when with wife and children we stroll along the bordered flowery walks, or sit in sweet converse under the umbrageous trees your hands have planted, just as the declining sun is fringing the horizon with rosy promise of a fairer to-morrow, and parting day is ushering universal nature to repose.

I have spoken thus freely of the benign influences of rural life and rural pursuits, for I have ever believed that an intimate relation exists between the beautiful, and things which are morally good; I trust therefore that my friends with whom I have labored so long, will pardon me for the allusions to myself. From my early years I have been fond of contemplating the glorious works of creation and Providence. I love the sublime as well as the beautiful in nature. I love to hear the thunder roll its treble diapason through the skies. I love to see the lightning flash its fiery gleam from pole to pole, and I delight to muse with nature in her more tranquil and enchanting scenes of rural bliss. I love the genial spring, filling the heart with joys renewed, and hopes of abundant harvest; the golden summer, marshalling its gorgeous retinue of successive glories; the mellow autumn, pouring from her horn of plenty the ripened treasures of the year. And especially do I love to be associated with the members of this Board in efforts to improve and increase the products of the earth,—something to promote the comfort, happiness, and welfare of my fellow-men,—something that shall live when we are dead.

SECOND DAY.

WEDNESDAY, Dec. 3.

The Board met at 10 o'clock.

ON SOME HOME RESOURCES OF FERTILIZERS—WITH PARTICULAR REFERENCE TO NITROGEN PLANT-FOOD.

BY CHARLES A. GOESSMANN.

Among the few elements thus far generally recognized as essential for the growth of plants, there is none more conspicuous than nitrogen. A difference of opinion of leading scientific investigators regarding the extent of its available natural resources for agricultural purposes, and its influence on the successful cultivation of farm crops has rendered it a most prominent topic of controversy in the agricultural literature of a more recent date.

As years of careful experimental inquiry in the laboratory, the plant-house, and upon the field have since greatly advanced our information concerning these questions, it seemed to me a suitable task to open the discussion assigned for this morning with a short exposition of the views which are at present entertained by agricultural chemists regarding these points.

First—I propose therefore, if acceptable, to treat on the properties of nitrogen and its relation to plant-life.

Secondly—The natural sources of nitrogen for agricultural purposes, with reference to their agricultural value.

I.

THE PROPERTIES OF NITROGEN AND ITS RELATION TO PLANT-LIFE.

Nitrogen in its elementary condition represents seventy-seven weight parts of the air; it exists in every natural body of water, and it permeates all kinds of soil.

In combination with hydrogen, as ammonia, and with oxygen, as nitrous and nitric acid, it forms in small quantities a constant admixture of both air and soil. Whilst united with

carbon, hydrogen, oxygen, sulphur and phosphorus, it constitutes, as so called, nitrogenous matter, a prominent part of every vegetable and animal organ.

Nitrogen in its free or uncombined state is a permanent gas, somewhat lighter than air (–0.972 spec. grav.—Dumas); it has no odor, no color, no taste; and is most remarkable on account of its chemical indifference towards other elements.

All its combinations are produced, as a general rule, by more or less circumstantial modes of operation; they are all more or less characterized by a certain degree of instability, and are thus in an unusual degree liable to decomposition.

Nitrogen does not directly unite with oxygen or hydrogen or carbon or sulphur or phosphorus, the very elements which constitute the entire organic portion of plants and animals.

To combine it with oxygen requires the assistance of the electric spark, or some other powerful physical or chemical agent, which excites electrical changes. Evaporation, condensation and combustion are known to produce the chemical combination of the oxygen and the nitrogen of the air to nitrous and nitric acid.

The same condition applies with still greater force to the behavior of nitrogen towards hydrogen, in the formation of ammonia.

Nitrogen and hydrogen unite to form ammonia only then, when they meet just emanating from decomposing compounds; and are consequently still in a peculiarly excited electrical condition.

To combine, chemically, carbon with nitrogen requires an intense heat, and the presence of strong basic elements, like potassium and sodium.

An economical way to force the nitrogen into a chemical combination with either oxygen, hydrogen or carbon, has still to be discovered: past attempts in that direction have thus far been but partly encouraging. The successful solution of that problem will eventually affect the agricultural industry far more than at first glance might be presumed: it would secure, if nothing else, for fertilizing purposes, the entire amount of animal refuse material which serves for the production of ammonia needed for other industrial purposes.

Among the preceding remarks, there are two to which I

invite your particular attention: *First*, that nitrogen occurs in two distinct conditions in nature, namely, as free uncombined nitrogen, or in combination with other elements; and, *secondly*, it is an indispensable constituent of every organ of plants and animals.

Accepting these statements as facts, we ask quite naturally as next in order, In what relation does the nitrogen stand in its various natural forms to organic life in general? Do the free nitrogen and the combined nitrogen—as ammonia, or nitric acid—or the more complex forms of organic nitrogenous substances, act alike beneficially on growing plants? Thanks to the labors of De Saussure, Liebig, Boussingault, and others, our answers to these questions are to-day quite concise. De Saussure was the first investigator who assumed the indifference of the atmospheric free nitrogen towards plants. Liebig supported subsequently his assumption by theoretical arguments, and Boussingault proved it by experiment as correct.

Professor Ville's observations, which seemed to contradict Boussingault's results, have lost their importance since Law's, Gilbert's and Pugh's careful series of experiments have been published. It is therefore at present generally conceded that plants cannot directly assimilate the free nitrogen of the air, but have to supply their wants from already existing nitrogen combinations.

Ammonia and nitric acid are recognized in consequence of experimental demonstration as the principal forms of nitrogen, which the vegetable organisms can convert into plant-food; whilst the more complicated organic nitrogen compounds, so called nitrogenous substances, are known to serve directly as plant-food only in the earliest stage of the young plants, during the formation of the first leaves, and also in the case of parasitic plants. For all other purposes in the vegetable economy, they have to undergo a total disintegration, and their nitrogen has to be changed into nitric acid or ammonia, according to circumstances, before it is fit for assimilation by leaves and roots. Considering, then, the question settled, regarding the only form in which the nitrogen can serve as plant-food, it becomes of interest to study the natural resources of nitrogen convertible into plant-food, with reference to their availability for the successful cultivation of farm crops.

II.

NATURAL RESOURCES OF NITROGEN PLANT-FOOD, WITH REFERENCE TO THEIR AGRICULTURAL VALUE.

The air and the soil are the natural storerooms of ammonia, nitrous and nitric acid.

Beginning our inquiry with the air, we know from numerous actual examinations, that it contains at all times small quantities of ammonia, in combination with nitrous acid or nitric acid, or in case both are wanting, with carbonic acid.

Peculiar meteorological phenomena, as thunder-storms, are known to affect the relative proportions of nitric acid and ammonia; whilst the season and the locality control their absolute quantity.

Densely populated districts show more than thinly settled sections of the country. Long periods of dry weather tend to increase their quantity in the air, whilst frequent rain-fall, heavy dews, or snow-fall, diminish their amount by carrying them into the soil. A few well supported statements of observations referring to these points may convey some more definite idea.

Liebig noticed in 1826, for the first time, the presence of nitric acid and ammonia in rain-water.

Bineau and Barral, who, in 1852 ascertained at the astronomical observatory at Paris the amount of nitric acid and ammonia contained in the entire annual rain-fall, found it consisting of twenty-seven kilogrammes of ammonia and thirty-four kilogrammes of nitric acid per hectare, or twenty-two pounds per acre. Observations at Nantes and Lyons gave similar results.

Boussingault, who had carried on similar tests during the same year, upon his farm at Liebfrauenberg, in the Alsace, found but one-seventh of Bineau and Barral's results; namely, three and one half pounds of nitrogen per acre.

Gilbert and Way, who made observations at Rothamstead, in England, during the years of 1855 and 1856, found one-third of Bineau's results, or between from seven to eight pounds per acre.

Knop found at Moeckern (1860) in the month of July,

0.57 millionth parts of nitric acid in the rain, and during the same month, after a thunder-storm, 9.8 millionths parts, or 17.5 times more than before.

The same distinguished investigator noticed, also, from 1 to 2 millionth of ammonia as the usual amount in the rain, and from 1 millionth to nothing in the snow.

Of particular interest here are the results obtained by five German experimental agricultural stations (Kuschen, Regenwalde, Dahme, Insterburg, Ida-Marienhütte), during the years of 1864, 1865 and 1866. The results obtained varied in regard to the relative proportion of ammonia to nitric acid, from 2.29 of the former to 0.46 of the latter, and again at times from 1.16 of the latter to 0.67 of the former.

The absolute annual amount of nitrogen obtained in both forms was found fluctuating per acre from 2.0 to 14.89 pounds.

The annual rain-fall in the various localities had been as high as 26.7 P. inches; and as low as 15.5 inches. The largest amount of nitrogen was noticed in the case of the most copious annual rain-fall: the periodical distribution of nitrogen corresponded with the relative proportion of the rainfall. The mean of the annual supply of nitrogen plant-food was 8.7 pounds per acre.

Comparing the quantity of nitrogen contained in our best commercial nitrogenous fertilizers with the largest annual yield of atmospheric nitrogen plant-food, namely, that noticed in the midst of Paris, we find it equal to that contained in 150 pounds of potash-nitre, 140 pounds of Chili saltpetre, 110 pounds of sulphate of ammonia, 130 pounds of Chincha guano, 4,200 pounds of half-rotten stable manure.

In the case of the smallest annual yield of but 2.0 pounds per acre, it would be equal to that quantity of nitrogen which we buy in 10 pounds of sulphate of ammonia, 12.5 pounds of Chili saltpetre, 12.5 pounds of Chincha guano, 15.5 pounds of potash-nitre, and 400 pounds of half-rotten stable manure.

Nobody familiar with the amount of nitrogen carried off in our ordinary farm crops, would hesitate for a moment to pronounce the available amount of atmospheric nitrogen plant-food, obtained by rain-fall, as previously illustrated, as insufficient in quantity.

Boussingault, in his experiments upon his farm, found that the best devised practical rotation, aiming at an economy of nitrogen plant-food, would annually require, in a five years' course, not less than forty pounds of nitrogen per acre. He raised potatoes, wheat, clover, turnips, and oats. In fact, there would be no reasonable cause for a difference of opinion regarding the degree of importance we have to assign to the air as a source of nitrogen plant-food, were it not for the fact that, plants and soil are known to absorb at all times more or less of it from the air, without the assistance of rainfall, etc.

The value which ought to be conceded to this almost uninterrupted reaction of the plant and the soil on the available nitrogen compounds of the air, has been variously estimated by different investigators, and subsequently furnished the material for dissenting views regarding the propriety and the economy of an additional supply of nitrogen plant-food to our crops. The extreme views at first entertained on both sides concerning the particular importance of nitrogen, for the production of good crops, have since been compromised.

Years of careful experimental inquiry under well defined circumstances have made us better acquainted with the *relative* importance and the *mutual* dependence of the various articles of plant-food on each other for the production of an increased vegetable growth.

The nitrogen is now recognized as in a peculiar degree important for a luxuriant development of the cellular system; yet also considered powerless, like potassa or phosphoric acid, without an adequate supply of the essential ash constituents of the plants under cultivation.

To-day there is practically but one opinion regarding the importance of the air as a source of nitrogen plant-food. Since Boussingault, Sachs, Ville, Gilbert and others have experimentally confirmed, by raising plants in an artificial atmosphere of ammonia, that all broad-leafed plants in particular absorb at all times more or less nitrogen plant-food from the surrounding air, a greater importance is generally conceded to the latter as a valuable resource in the case of leguminous plants, as clover, and of a perennial growth like forests and meadows.

The recognition of this fact is, however, modified by the statement, also experimentally established, that the air alone cannot supply, even under the most favorable circumstances, a sufficient amount of nitrogen plant-food to secure a maximum yield of many of our farm crops.

Intensive farming, even in case of a most favorable rotation, requires, as Boussingault has demonstrated, an additional supply of nitrogen plant-food. Hellriegel, who experimented with a richly foliated lupine, noticed that in case the plants were raised in a soil entirely free from any nitrogen compounds, yet abundantly supplied with suitable mineral plant-food, only one twenty-fourth part of the organic matter was produced as compared with cases in which a suitable nitrogen plant-food had been added. Clover gained more. He also confirmed again the earlier observation of Wolff and others, that the air is a far more efficient source of carbonic acid for plant-growth than of nitrogen.

Taking even for granted that the available annual supply of nitrogen compounds of the air should be considered, as far as their entire quantity is concerned, equal to the amount required for a good crop, there remain still strong doubts, whether the available supply would be sufficient to meet the periodical demands of the plants.

The efficiency of any article of plant-food, considering all other circumstances equally favorable, does not so much depend on a sufficient quantity to meet the requirements of the entire period of growth, but to furnish enough for the periodical individual wants of the plants under cultivation.

Different plants behave differently, regarding the amount of nitrogen they need during their various periods of growth.

Scheven found that in the case of barley, taking its entire amount of nitrogen, in its perfectly ripened state, equal to 100;—1.4 per cent. of nitrogen had been absorbed daily, during its first stage of growth; 2.4 per cent. per day until its blooming; 0.27 per cent. daily, during the first period of the ripening of the seeds, and but 0.15 per cent. afterwards, until perfect ripeness.

Dietrich, on the other hand, found in the case of the clover, that 6.0 per cent. of the entire nitrogen of the per ectly ripened plants are absorbed until the stems are growing,

36. per cent. until the blooming begins, 50. per cent. during blooming, and 8.0 per cent. after that period, until the seeds are ripe.

The peculiar distribution of the available nitrogen compounds of the air throughout the entire year apparently do not comply, as to the time needed, with conditions as previously illustrated.

As it is not prudent to trust to mere chance, when the means which may secure success are within our reach, we do best to choose the safer course, and consider the atmospheric supply of nitrogen insufficient for the purposes of intensive farming.

Having thus briefly pointed out what we assume about the nature and the extent of the atmospheric supply of nitrogen plant-food, it remains for me to treat of the relation in which the soil stands to plant-life, as far as its function as a resource of nitrogen is concerned.

The soil contains nitrogen plant-food in three distinct forms; namely, as ammonia, as nitric acid, and as organic nitrogenous compounds—resulting from decaying organic, vegetable and animal matters.

The ammonia of the soil is derived either from air or from decaying organic substances. Its amount in well cultivated land seems to be of constant quantity for every kind of soil, and as a general rule much less than the earlier examinations of Bustlein, R. Hoffman, Wolff and others represent. According to these authorities, there have been found from one-half to two ten-thousandth parts of ammonia in various kinds of soil. Progress in analytical modes of examination have reduced those figures.

W. Wolff and W. Knop, in their late valuable investigations, do not find it higher than from one hundred thousandth, to one-millionth part of the soil. They found the ammonia only in the surface layers. At six feet depth no trace could be recognized. As neither rain-fall nor the presence of decaying organic matter seemed to affect this proportion for any length of time, it is quite obvious that the soil ordinarily must contain all the requirements to change the ammonia continually into nitric acid.

These facts regarding the behavior of the ammonia of the

soil are frequently cited as a strong argument in favor of the opinion entertained by some leading agricultural chemists (Wolff), namely, that its functions as a nitrogen source for the roots are altogether of a secondary importance.

Whatever way future inquiries may decide regarding this assumption, it is evident that the ordinary amount of ammonia in the soil, as previously stated, cannot secure the largest possible yield of farm crops.

Dr. Hellriegel, who since 1863 has been engaged with experiments concerning the question, How much of the various articles are needed to secure the highest possible yield of some of our prominent farm crops? found that the smallest amount of nitrogen required to secure the highest yield, taking, of course, all other requirements equally favorable, amounts in the case of wheat to seventy-three (73) pounds of convertible nitrogen for every one million pounds of earth; for rye, sixty-three pounds; for oats, fifty-six pounds, consequently, under even favorable conditions, at least many times as much as the soil, in the form of ammonia, ordinarily contains.

The second form in which the convertible nitrogen occurs in the soil, consists in the nitric acid. This acid is derived periodically, as we have seen, from the air by means of rainfall, dew or snow-fall, and also from the oxidation of the ammonia under the influence of basic oxides, like lime, etc. Its main quantity, however, depends on the disintegration, and subsequent oxidation of the animal and vegetable matter stored up in the soil. As the process of their oxidation requires a full access of the air, we notice the formation of nitric acid particularly in the surface portion of the soil, the compost heap, and even the manure pile.

The nitric acid forms very soluble compounds with every basic article of plant-food; it passes, comparatively speaking, quite rapidly to the subsoil, and forms, in combination with lime and magnesia, a normal constituent of the drainage waters of cultivated lands.

It is here of interest to notice, that ammonia and nitric acid behave quite differently towards the soil; for the former is retained, as we have seen, in the surface soil, whilst the latter passes by the aid of percolating waters to the lower

layers. The tendency of the nitric acid to withdraw from that portion of the cultivated soil, upon which most of our farm-crops feed, renders it quite natural that its efficiency as a plant-feeder can be secured in an economical way, only by a continual production, equal to the demand. As decaying animal and vegetable organic substances furnish consequently either ammonia or nitric acid, they are in a superior degree qualified to supply the nitrogen plant-food for our crops, provided they are present in a sufficient quantity, and in a suitable form of disintegration.

In their advanced state of decay as humus, they contain still, from 2 to 4 per cent. of nitrogen.

It is therefore considered most essential for every kind of soil under cultivation, to contain at all times a certain percentage of it.

Uncultivated lands, as a general rule, are more or less destitute of it, for a scanty growth reduces its amount, directly and indirectly.

From the preceding remarks regarding the character and the extent of the various natural nitrogen resources of the soil, it must be apparent that they cannot and ought not to be relied on, when aiming at remunerative farming.

Intensive farming does not mean to tax the natural strength of the soil to its utmost limit, but to increase the store of its movable or convertible plant-food by rational and economical means to the highest possible amount; the larger the export and the import of plant-food, the more intensive is the system of cultivation.

It is of particular importance, to provide for the young plant in its earliest state of growth a sufficient amount of active nitrogen compounds, for its presence is essential for the formation of cells; it stimulates the growth of leaves and roots, and places thereby the young plant in the most advantageous condition to take hold of the resources of both air and soil.

To restore to our more or less *exhausted* lands at the proper time, and in a suitable form, the various articles of plant-food, which the latest crop has abstracted, does not entitle to the highest expectation.*

* The following tables show the *amount of nitrogen, potassa* and *phosphoric acid* contained in an air-dry average *crop* per *acre* of Massachusetts, according to

These tables may serve as a basis on which to calculate the amount of nitrogen, potassa, and phosphoric acid, contained in the crop in any particular instance.

Such a course of operation cannot secure the highest yield which the lands under cultivation are capable of producing. Our steady aim must be to enrich the soil again with ready plant-food, keeping always in mind that the latter represents the capital put on interest.

Large crops are not always a proof of a judicious management; they may render the father comfortable at the expense of the son; for experience almost everywhere teaches that it

the report of the United States Department of Agriculture, for the year 1871. Calculated from Wolff's tables, by C. Wellington, graduate of Mass. Ag'l College :—

I. For the Seed.

CROP.	Average Yield per Acre.		Water.	Nitrogen.	Potassa.	Phosphoric Acid.
	bushels.	lbs.	lbs.	lbs.	lbs.	lbs.
Indian Corn, . .	34.3	1,920.8	261.23	30.73	6.34	10.56
Wheat, ...	18.2	1,092	156.16	22.71	6	8.95
Rye, ...	18	1,008	150.19	17.74	5.44	8.27
Oats, ...	31.4	1,004.8	140.67	19.29	4.22	5.53
Barley, ...	24.2	1,161.6	168.43	17.66	5.58	8.36
Buckwheat, . . .	15	720	101.52	10.37	1.5	3.17
Potatoes (tubers), .	126	7,560	5,670	24.19	42.3	13.6
Tobacco (leaves), .	–	1,450	261	–	78.44	10.29

II. For the Straw or Stalks.

CROP.	Average Yield per Acre.	Water.	Nitrogen.	Potassa.	Phosphoric Acid.
	lbs.	lbs.	lbs.	lbs.	lbs.
Indian Corn, ...	5,122.1	717.1	24.58	85.03	19.46
Wheat, ...	2,275.4	320.83	7.28	11.15	5.23
Rye, ...	2,352	354.41	5.64	17.87	4.42
Oats, ...	1,507.2	212.52	6.03	14.62	2.71
Barley, ...	943.8	132.13	4.53	8.78	1.79

III. For the Entire Plant.

	lbs.	lbs.	lbs.	lbs.	lbs.
Indian Corn, ...	7,042.9	978.33	55.31	91.37	30.02
Wheat, ...	3,367.4	476.98	29.99	17.15	14.18
Rye, ...	3,360	504.6	23.38	23.31	12.68
Oats, ...	2,512	353.19	25.32	18.84	8.23
Barley, ...	2,105.4	300.56	22.18	14.35	10.15
Hay, ...	1,920	276.48	25.15	32.83	7.87

takes years of hard toil to correct the mistakes of former generations. They had some excuse; we have none.

As the increase of active plant-food in our farm-lands ought to be one of the prominent objects of every system of farming, we ask quite properly here, By what economical means can this result be secured as far as the nitrogen plant-food is concerned?

To answer this question necessitates a few general remarks concerning the customary modes of increasing our crops. A soil may be improved, physically and chemically, or in both directions; its latent resources may be rendered merely in a higher degree available; or a direct addition of plant-food may be made. Those modes of treatment which aim at the last-named result only can enrich the soil; the others virtually tend to hasten on its early exhaustion.

Superior mechanical treatment, subsoiling and drainage, aid in improving the physical condition of the soil, and render the latent resources more active; without the support of a rotation of crops or manuring, they tend to exhaust it.

Fallow causes an accumulation of general plant-food at the expense of time. Its merits regarding the accumulation of organic nitrogen plant-food are frequently more than doubtful.

Wherever the surface soil is left unshaded against the stimulating action of the direct sunlight, a wasteful decomposition of its stored-up organic matter must result. Irrigation aids mainly in a uniform distribution of the latent plant-food of the soil, and increases its amount only in exceptional cases.

Rotation of crops and direct manuring alone, can really enrich our lands with nitrogen plant-food, and at the same time improve, to some extent at least, their physical condition.

I do not intend to discuss here in detail the special merits of these various modes of improving our farm-lands, and to state from the stand-point of an agricultural chemist, under what circumstances and in what connection they ought to be turned to account, to secure the best possible results; but will confine myself to a short exposition of some of the principal means by which, in an economical way, an efficient supply of nitrogen plant-food for a general farm management may be obtained.

A rational system of rotation claims, in this connection, our first attention.

The crops ought to be selected with a particular view to economizing and accumulating the atmospheric resources of nitrogen.

Leguminous and other deep-rooting, broad-leafed plants are known to accomplish this object.

These crops are, by a natural organization of their leaves, in a superior degree fit to absorb in an advantageous way the nitrogen compounds of the air, and prevent, in consequence of their luxuriant leaf-growth, a wasteful decomposition of the organic matter in the soil by shading it. They send their root to an unusual depth, and turn thus, in part at least, to account that portion of nitrogen which, as nitric acid, has found its way to the subsoil, and is thereby lost to many of our farm-crops, the grain-crops in particular.

In cultivating, to some extent, deep-rooting plants for feeding purposes, we enrich indirectly, in a safe and economical way, the surface-soil at the expense of the subsoil. They increase, in consequence of their unusual root-growth, the vegetable organic matter of the soil, which, as has been shown, is the most reliable form of storing up the nitrogen and other articles of plant-food for succeeding crops; and improve by their shrinking the mechanical condition of the entire body of the agricultural soil.

Such results are not surprising, when we consider that the roots of lucern are frequently from twenty to thirty feet long, those of the lupine from seven to eight feet, of the clover from five to six feet, of the beet from six to eight feet, and more.

Dr. Weiska, of Proskau, who, by careful actual experiment, has studied these questions more in detail, states that the nitrogen left upon the soil, in the form of stubble and roots, amounts, in a good average crop per acre,—

In the case of red clover, to	180	pounds.
Lupine, to	58	"
Pease, to	53	"
Buckwheat, to	45	"
Rye, to	62	"

Oats, to	25 pounds.
Barley, to	22 "
Wheat, to	22 "

These figures explain quite satisfactorily why some crops, which contain, comparatively speaking, but small quantities of nitrogen, quite frequently exhaust the soil far more in that article of plant-food than others which contain a much larger quantity of it.

We know from exact comparative analytical tests, that an entire average crop of wheat, rye, barley, oats, flax and buckwheat contains but from thirty-eight to forty-five pounds of nitrogen per acre, whilst hops, meadow-grasses, Indian corn, rape, and potatoes, contain from fifty to seventy-five pounds; and, finally, tobacco, pease, lupine, lucern, and beets, etc., contain not less than from seventy-five to ninety pounds. Yet practical experience counts, when classifying these crops with reference to their actual effect on the nitrogen plant-food of soils, grain-crops, rape, tobacco, potatoes, and other hoed crops, among the very exhausting crops; pease, vetch and buckwheat among the most saving ones; and clover, lucern, esparcet, lupine, etc., among those which enrich, in a decided degree, the soil with nitrogen plant-food. To introduce the last-named class of crops, whenever practicable, into a system of rotation will always operate in the interest of an economical use of nitrogenous fertilizers.

The second step towards an accumulation of ready nitrogen plant-food consists in the saving of all vegetable and animal refuse material, incidental to the industry pursued; for all contain more or less nitrogen compounds, and differ in fact more in regard to the quantity than the quality which they contain.

The most prominent substances, which deserve in this connection our attention, are the animal secretions.

The quality of these refuse matters depends, first, on the kind, the age, and the employment of the animal from which they are obtained; and secondly, on the kind and the amount of food consumed.

Every class of our domesticated animals requires for its daily support a certain varying amount of nitrogenous com-

pounds; their secretions differ, consequently, regarding their amount of nitrogen. Full-grown animals return in their secretion the entire amount of nitrogen consumed in their food; young animals retain some of it for their growth; cows pass part of it in their milk; and the sheep in the wool.

The secretions of high-fed oxen contain often two and one-half times as much nitrogen, and three and one-half times as much phósphoric acid as those obtained from cows or young cattle.

It is a quite customary practice upon large estates to calculate the amount of nitrogen contained in the secretions of the entire farm-stock, from the nitrogen contained in the food consumed by making an allowance of twenty-five per cent. of nitrogen lost in other directions, as milk, texture, etc. Cows or oxen, for instance, which require for their daily support, at the rate of from 6.5 to 7 ounces of nitrogen in their food for 1,000 pounds of live weight, consume at that rate annually from 148 to 171 pounds of nitrogen; deducting as stated 25 per cent. for other purposes, we find that from 111 to 128 pounds of nitrogen will be contained in their fresh secretions. This quantity of nitrogen would be equal to that contained in from 750 to 800 pounds of the best Chincha Island guano, or in 3,200 pounds of bone-meal, or in 25,000 pounds of half-rotten barn-yard manure.

The efficiency of the animal secretions as a nitrogenous fertilizer depends, to an unusually large degree, on the preservation of the entire amount of both the liquid and the solid portions.

The liquid manure contains all the soluble constituents of the food, which represent, quite frequently, the most valuable portion of the fertilizing substances of the entire secretions.

The amount of nitrogen contained in the urine of our domesticated animals differs widely, independent of the kind of food consumed. The nitrogen contained in the food has been found distributed in their secretions as follows:

In the case of	Cows.	Oxen.	Sheep.	Horses.	Mean.
In solid excrements, .	45.5	51.0	43.7	56.1	49.1
liquid excrements, .	18.3	38.0	51.8	27.3	34.0

—*Wolff.*

To secure the urine of our farm-stock deserves, therefore, a most careful attention. Its presence is essential for the production of a complete fertilizer, for the reproduction of the crops which served as food; its absence depreciates the value of the stable manure more than one hundred per cent. To suffer the liquid manure to waste, means loss of nitrogen, and potassa in particular. The fresh animal secretions contain but little ammonia; they evolve it largely, however, soon, in consequence of a peculiar process of fermentation, and are thus liable to suffer seriously in nitrogen compounds.

As humus and a rich loamy soil, or turf, are in a superior degree qualified to absorb ammonia, they deserve recommendation for that purpose.

Dry, fresh, vegetable, refuse material, as straw, leaves, and so forth absorb readily the liquid manure, yet they are but little fit to take care of the ammonia before they have changed to a certain degree of humification.

An addition of soil or a daily sprinkling with pulverized gypsum, or crude sulphate of magnesia, is, for this reason, of particular importance in case of fresh stable manure; partly rotten manure, if properly mixed, does not evolve ammonia to any extent.

The incorporation of all kinds of vegetable refuse material, incidental to the industry pursued, into the stable manure is to be recommended, for they decompose more readily when mixed with highly nitrogenous substances, like the animal excretions; and they tend to render the stable manure more efficient for the crops under cultivation. Grain and straw contain the same articles of plant-food, and differ merely in regard to the relative proportion of the latter.

Numerous actual experiments made in connection with stock-feeding have furnished us with a good mode to calcu-

late, at least approximately, the annual production of barnyard manure for every kind of animal.

A short enumeration of the facts on which such calculations are usually based may be of interest.

First, the entire fresh secretion of cattle, sheep, and horses, amount, on an average, to 50 per cent. of the dry substances (at 100° C.) of the food consumed.*

Secondly, one-fourth of the weight of dry substance consumed as food is required in dry straw, to absorb the secretions; and thirdly, the stable manure contains, on an average, 25 per cent. of dry substance and 75 per cent. of water.

From these statements we learn that, for every 100 pounds of dry food consumed, 300 pounds of stable manure are obtained.

Taking for granted, that for every 1,000 pounds of live weight of ordinary farm-stock are usually fed 24 pounds of dry fodder, and allowing ($\frac{1}{4}$) six pounds of straw for bedding, we find that the daily produce of manure in the case of stable-feeding amounts to 72 pounds, or per year to 26,280 pounds. The amount of straw used as bedding modifies this figure somewhat, for in case of horses are needed 6 pounds, of cows 8 pounds, of pigs 4 pounds, and of sheep 0.6 pounds of wheat-straw.

The average stable manure produced in general mixed farming contains, in a well preserved state, in one thousand pounds, from 4.5 to 5.8 pounds of nitrogen, provided the farm live-stock, which contributed to its production, has been well fed.

The commercial value of stable manure may be, approximately at least, ascertained by allowing for every ton about ten pounds of potassa, eight pounds of nitrogen, and

* The dry substance of food, according to Wolff, is found to be distributed in the case of—

	Cows.	Oxen.	Sheep.	Horses.	Mean.
In the urine,	9.1	5.8	6.6	3.6	-
fæces,	38	45.4	46.9	42	-
Total,	47.1	51.2	53.5	45.6	49.4

four pounds of phosphoric acid; its agricultural value, as a general rule, stands higher than any commercial artificial fertilizers, containing these substances in the proportion previously stated; for stable manure does not only add plant-food; it acts, also, beneficially on the physical condition of the soil.

The only serious objection which can be urged against the exclusive use of stable manure for fertilizing purposes in a mixed general farm management consists in the fact that it usually becomes, sooner or later, an incomplete manure for the crops under cultivation, in consequence of the more or less general practice of selling various kinds of farm produce, without restoring in some suitable form to the soil, at least their ash constituents.

There are two ways by which barn-yard manure may be made a complete fertilizer for any farming system, and they are: to restore either the soil constituents, sold in the farm produce, by buying rich food in addition to the fodder-crops raised, or by securing an efficient amount of a suitable commercial concentrated fertilizer. Which of these two courses will be the most economical, cannot be well decided on mere general principles beyond the statement that, the first course, the buying of strong food, seems to be the safest and most efficient, in general farm management; whilst the second course, the buying of concentrated commercial fertilizers, deserves quite frequently especial recommendation for the cultivation of certain industrial crops.

Having within the previous pages thus attempted to render somewhat more prominent the character and the value of our home resources of nitrogenous fertilizers, I conclude with a short enumeration of the cases, for which the application of economical concentrated fertilizers is usually urged.

To aid indirectly in a speedy production of an efficient quantity of home fertilizer;

To render new land soon fertile;

To restore the fertility of exhausted lands with the least delay;

To bring fertile lands to their maximum yield;

To correct the peculiar effects produced by a frequent culti-

vation of special commercial crops, and also those of a faulty rotation of crops on the condition of the soil resources;

To strengthen sickly young crops by surface treatment;

To produce good crops without the aid of stable manure.

All these objects may be advanced by the rational use of the concentrated commercial fertilizers; provided they are what they ought to be, of a reliable character, as far as their *mechanical* condition and their *chemical* composition are concerned.

As this is the first opportunity which presents itself to me to appear before you, since my election as your agricultural chemist, I take the liberty to express my most sincere thanks for the great honor conferred upon me. May the future prove to you that your choice was not a mistake.

Among the duties assigned to me since my appointment, is that of acting as an inspector of fertilizers, according to the new state law for the regulation of that trade. I need not assure you, that I believe in the propriety and the usefulness of such laws. I know from actual observation elsewhere, that they are aiding in a sound development of the fertilizer trade, and benefiting the farmer and the honest dealer; provided the rights of both are duly recognized.

No dealer in any other article of merchandise would act prudently to refuse an intelligent statement of what he wishes us to buy of him; or to consider it an encroachment upon his privileges, when we propose to find out whether we get the value of our money. The fact that the farmer, for various obvious reasons, chooses to transfer that decision to a third party, whom he considers better qualified to attend to his interest, does not alter the position of the dealer. All the farmer aims at by these laws, is to learn whether the prices charged for the various ingredients he buys in the form of fertilizers are corresponding with their commercial value.

He trusts in competition as the proper regulation of prices. The dealer who sells his fertilizers at an honest price is not responsible for the failure of crops, which may happen during their application.

The *commercial* value of a fertilizer, and the *agricultural*

value, are not to be decided by the same standard. As soon as these points are once properly recognized it will be considered not less than a blunder on the part of any dealer to object to laws, which propose to make a public distinction between the honest man and the rogue in his line of trade.

The new law contains some decidedly good provisions; yet it is in my opinion, in some essential points deficient.

I do not intend to discuss here, the various sections of the law; I leave that task to others, but will confine myself to a few remarks regarding the position of the inspector.

1. The law charges the inspector to collect samples of fertilizers, and to present his bill subsequently to the dealer, which proceeding appears to me as fining the man before he is found guilty.

2. The inspector is expected to take samples throughout the entire State. As the main trade in fertilizers in the State is in the hands of comparatively but few parties, these without any distinction whatever, whether honest or not, will have to carry indirectly the pecuniary burden of the new law.

Some reflection on this point will render it quite plain that the inspector must find himself quite frequently under some restraint to collect samples of one and the same party, although he may deem it advisable, and in the interest of an impartial proceeding.

3. The law does not provide the pecuniary means to carry it out efficiently. The sum allowed for an analysis scarcely covers the expenses of transportation, outfit, chemicals and assistance; leaving the labor involved unpaid.

With these disadvantages before me, I have collected some twenty samples of fertilizers, simply with the view to study the present condition and resources of our fertilizer market, and propose to present the analytical results, if acceptable, at the next meeting.

To accomplish this work, I strained the resources of my department, in an unusual degree; most of my time during several months, not engaged in class duties, has been spent in making analyses, and in collecting useful information. My direct expenses partly at my own risk, have been from \$150 to \$200. The income of the office, amounts thus far to \$15, which I hesitate to collect.

Under these circumstances, it will not appear strange that I feel as if I could not support the office much longer.

In presenting my views to your kind consideration, I offer my professional services, most cheerfully for the future.

The CHAIRMAN. The subject of commercial fertilizers has been opened by Prof. Goessmann in a very acceptable way, and we shall be happy to hear from any one who may wish to speak upon the question. I would call on Dr. Loring to continue the discussion.

Dr. LORING, who was called to the platform, said: I have not taken the platform, Mr. Chairman, with any purpose of making a long speech; I have simply come here to encourage the meeting to follow out the discussion which has been so aptly opened by Prof. Goessmann. I have listened with the rest of you to the admirable, simple and attractive manner in which he has presented the scientific investigations which he has made into the value of chemical fertilizers when applied to the soil for the purpose of raising crops. I have no doubt the time is coming when the farmer will be enabled to supply himself with condensed fertilizers in such form and with such certainty, that he can, if he desires, escape the expensive and troublesome mode in which he now provides himself through the instrumentality of the animal kingdom. Is that assuming too much, Professor? The Professor says it is not assuming too much, and I assure you, gentlemen, that much as I am attached to my animals, well as I like a good cow, religiously as I believe in a good horse—led on to that belief by a gentleman whom I consider to be one of the best theologians of this State—I still shall consider it a blessing to the farmer when he can go to the Agricultural College, or to a reliable chemist, or to an honest and faithful dealer, and provide himself with fertilizers in an economical form, as a substitute for that which he now receives from his animals. I have no doubt that what Prof. Goessmann has said with regard to animal fertilizers, the excretions of horses and cattle, is all true. There is not the least doubt that those excretions, properly prepared, provide us with all the constituents that we need for the fertilization o he soil. Nature has provided these substances with the nitrogenous compounds and the

soluble salts in such form, that they are peculiarly adapted to the soil into which they are introduced, and with proper combinations they can be made the best material which we now have for fertilization.

Compelled as we are to use animal excretions for the fertilization of our soil; compelled, I say, because the law of the State of Massachusetts—ample as it is, regardful as it is of the farmer's rights, liberal as it is towards the state chemist—is not sufficient in itself to secure to us the most cheap and reliable commercial fertilizers—what course shall we pursue? I have certain views which I have presented over and over again to the Board, some of which have been accepted and some not; I am never disturbed when they are not, and I am always pleased when they are; I do not think it will do any harm, therefore, to repeat some of them. Those that have been rejected can be rejected again; those that have been accepted can be pondered upon with the usual diligence that the farmer bestows upon all abstract questions presented to his mind. I think that fertilizers can be made especially applicable to the soil, and economically applicable, by a careful and accurate choice of the materials with which they are to be composted. Now, if I say anything wrong, I desire the state chemist to say so, because I am a learner, like the rest of you. I say the excretions of animals should be so combined in the compost-heap as to be made applicable to the soils to which they are to be applied. Now, nature has provided us with cheap, bulky substances, of various descriptions. In the first place, all the straw and refuse hay that is used as the bedding for animals, is useful; and the chemist has told you how the straw itself, decomposed, furnishes certain materials, acting chiefly mechanically, but chemically as well, upon the soil. I accept rye-straw and barley-straw, the latter of which is pretty good food, and is a better fertilizer when it has passed through our animals than when simply mixed in the compost-heap. Meadow hay I am opposed to. I do not believe in it even as bedding to work into the compost heap. I do not know why it is, but it disappears; and I am happy to know that it does disappear, for if it did not I am sure it would do more harm than good. I do not think a chemical analysis would show that ordinary coarse hay grown

upon bogs, contains any chemical properties that are advantageous to a manure-heap. I am sure that mechanically it is of little advantage, for a ton of meadow hay in a manure-heap will vanish as rapidly as snow before the sun in spring-time. I have spent hundreds of dollars for meadow hay for the compost-heap, and I do not mean to spend another dollar.

Muck, as a valuable article of food for plants, has been discussed over and over again. Let me say here, gentlemen, that I believe in muck just as far as a sensible man ought to believe in it and no further. I do not believe that, considered abstractly, by itself, it is a fertilizing material. I think it belongs to those materials which nature has provided for the benefit of the compost-heap; that it can be worked into a mass of barn-yard manure, in such a way as to increase the fertilizing power of that mass of pure animal excrement, just as straw can, and just as other materials can (always excepting meadow hay). So I would accept muck for that purpose, properly prepared and used as an absorbent. But, gentlemen, understand me; it is not applicable to every kind of soil. You might just as well tell me that a strong nitrogenous manure is as well fitted for corn as it is for cabbages or mangold-wurzels, or you might as well tell me that night-soil is just as good to raise Swedish turnips as superphosphate, in any form in which you see fit to apply it. Muck is applicable, therefore, in the compost-heap, to soils that are sandy and light, have an abundance of silica, have soluble salts already provided, which the latent acids in muck may possibly dissolve. Is that unfair? The chemist says, "No, it is not unfair;" he says that is the right way to get at it. Now, I say, take sandy soil, and, if you have got a sufficient supply of barn-yard manure which you wish to extend by the use of any composting material, you can use muck, and the acids remaining in the muck, after it has been exposed to the air and sun and frosts, so that it is thoroughly "sweetened," as the farmer says, will have a beneficial chemical effect upon your soil, by aiding to dissolve the soluble salts which go to nourish the plant. Just as far as that I will go on the muck question, and I think it is as far as the most cultivated chemist is usually willing to go. I do not believe

in hauling out a great mass of this material, and spreading it upon our soil, with the expectation that it will act as a fertilizer alone. Not at all. When my old friend, Horace Greeley, with whom, towards the close of his life, I am sorry to say, I differed on very many questions, asserted that he had fertilized a sand-bank at Chappaqua by simply placing the contents of an old pond-hole upon it, and had made that sand-bank produce a good crop of timothy hay by the use of this muck, all the answer I had to make to him was, that he had combined by the muck and the sand artificially what nature often combines in the manufacture of her best soils; but that when the immediate influence of that was over, he would be obliged to return at once to the use of animal excrements or some other fertilizer.

So I would use muck on sandy land, and if I had clay lands to manipulate, and rye-straw was expensive, I would use sand. I represent a clay farm; almost all the land I cultivate is of that character. When I took it into my hands, in 1857, it had been mucked to death; it had been filled with muck; muck was convenient; muck was popular; it had its advocates, and was accepted, as a good many other things are accepted, because no one exposes their true value. This land, I say, had been mucked to death, and having accidentally discovered a large deposit of sand in the rear of my stable, I resorted to that sand for the bedding of my cattle and the enlargement of my manure-heaps. The land changed in three years materially. The quality of my crops changed; half-grown, stunted mangold-wurzels were replaced by large, healthy-looking roots. Tufted grasses,—that is, fields where there would be a square foot of grass, and six inches intervening of barrenness,—were all wiped out, and an equal diffusion of healthy, thrifty grass was secured in its stead. It was owing to the introduction of sand with the manure into those lands that had been rendered sour and pasty by the muck. That was the result of that experiment. So, I say, if you have clay lands, extend your manure-heaps and compost them by the use of sand.

Now, you may say, What do you compost your manure at all for? Why do you not haul your barn-yard manure directly upon the land; and why bed your cattle at all?

Why not plunge your manure into the cellar and haul it there in a solid mass, and use it in a green state? For some purposes, this is well enough, I have no doubt. I think the best chemists will agree with me, that the earth is a tremendous laboratory. The capacity which the soil has of dissolving and dividing what is put into it for its own purposes and uses, is exactly analogous to the capacity of the human system to take up and divide and use the food that is taken into it for specific purposes. I have no doubt, that, under certain circumstances, green, solid barn-yard manure can be economically introduced into some crops. For instance, I think it can be introduced into the corn-crop. I am sure that the best way to raise corn is to plant it on new land, with the sod recently turned over, with barn-yard manure turned in, and a small quantity put in the hill. I am sure that in that way you can raise the greatest corn-crop. Why? Because, during the sixty days of hot corn weather, the earth and the heat are doing exactly what the farmer would have been doing in his compost-heap; and when the corn requires that manure, the earth, the sun and the heated air are busy preparing the food for its use. Experience has taught me that this mode of cultivating corn is a good one. But, experience has also taught me that for most crops well composted and well decomposed manure is by far the most useful.

And now, in decomposing our animal manures, we should not forget that while the manure is largely diminished by decomposition, the fertilizing power of the manure is largely increased, and never, until it is decomposed, is the manure fit for the food of the plant. Some of the most interesting experiments that have been made in modern times were made by the Royal Agricultural Society of England, and published in their transactions, setting forth exactly how much barn-yard manure was increased in value by decomposition; a series of experiments analogous to those admirable investigations now being carried on at the Agricultural College at Amherst, in the State of Massachusetts, and which, I am happy to say, are fast placing that college where it belongs, in the front rank of the agricultural institutions of the country. The result of all these careful experiments was this: In the first place, that all the soluble salts of manure were largely

increased by decomposition; that barn-yard manures that had been carried through the fermenting and heating processes, although they had lost in weight, were largely increased in their fertilizing power, not only in the soluble salts, but in the nitrogenous compounds which, as Prof. Goessmann has told you, are so valuable for the encouragement, at least, of the growth of plants in the soil. So I say, that the decomposition of manure when properly composted, is a very important and valuable consideration for the farmer, and should be carried on in the way most economical and most effective, using muck to extend your barn-yard manure for sandy lands, because sandy lands will not heat it sufficiently, by the use of sand for clay lands, by the use of straw for making grain-crops, and by the use of any nitrogenous compound that will increase the nitrogenous power of barn-yard manure, when you propose to raise cabbages, mangold-wurzels or any other heavy-feeding plants.

These are my views in regard to the preparation of what we usually call barn-yard manure. I believe in supplying it as far as possible. I shall set forth to-morrow, I suppose, what kind of animals we should have, and how they should be fed in order best to produce it; but I would urge upon every farmer the economical preparation of it in the way to which I have alluded.

Now, in regard to commercial fertilizers. The law which is on the statute book you have had expounded to you as well as any lawyer could have expounded it in the State of Massachusetts. Prof. Goessmann has told you all about it. But, gentlemen, I believe that the best way to get rid of many an evil is to keep out of its way. The farmers of Massachusetts can better afford to stop buying commercial fertilizers one year,—stop systematically and deliberately,—than they can afford to spend their money, as they have been spending it for years, in purchasing what is not worth a quarter part of the money they pay. Stop one year, and you have applied a law that every manufacturer will feel in a moment. He will say to himself, "Something has got to be done here. These men have found out that they want their money's worth"; and, as Prof. Goessmann says, they will find it is more profitable to them to manufacture a reliable article than it is

to manufacture one that is not reliable; more profitable to them in various ways. In the first place, it would increase their trade; and, in the next place, it would increase the consumption enormously in the State of Massachusetts. Why, if the farmers could rely upon the commercial fertilizers they purchase in the market, there is no telling the vast amount that would be immediately and rapidly substituted for the more ordinary forms of fertilizing material. Am I not right? Certainly I am. Now, if the farmer desires to know what in the world he is going to do for himself during that year of suspension, let him go to every ash-heap, and seize on every bone he can find, and buy a little nitric acid, and go to work and manufacture his own fertilizers, for the time being. Let him import ashes; let him take the real solid substance, and dilute it for himself. If he is going to have anything mixed, let him do his own mixing, and then he will get along well enough; there is no doubt about it at all. Why, not one-half the amount of ashes is used that should be. There are towns on this road that extends from here to Greenfield, and in all that agricultural section, in which ashes are largely imported and used. They should be purchased east and west, north and south, by the Massachusetts farmer, and applied to his crops. Peruvian guano imported and sold in bags is the foundation of enormous amount of extended fertilizing material. You can extend Peruvian guano just as well as the manufacturer of phosphates can, can't you? Take it then, and extend it; buy a bag, buy half a ton, and extend it for yourselves. Don't pay a man $40 a ton to extend it for you. But be sure and buy the real article to begin with; if you have got to dilute it, dilute it. Then there is a preparation now being made at Brighton, from the refuse of the Abattoir there, of which, I understand, some 125 tons are manufactured a week. That comes directly from the mill of nature herself. Buy that, and extend it yourself, if you want to, just exactly as the dealers in superphosphates are buying it and extending it for their purposes. Why can't you extend it as well as they can? Until you can get some reliable manufactured commercial fertilizers, fall back upon those which are provided by nature herself, and are pure, and then extend and dilute them to suit your own purposes. Carry that plan into

operation, and by and by our manufacturers of commercial fertilizers will try and keep up with you, and will try to do exactly what you are doing. Take the matter into your own hands, and it will not be long before you can buy superphosphates just exactly as you can the purer articles, which now escape adulteration, because they cannot be adulterated and made safe. That is my view of it. I approve of the law. I have no doubt it will be made useful. It is a law which will attract attention among manufacturers of commercial fertilizers. It is a law which will stimulate farmers to be more careful in looking after their own interests; which will encourage the manufacturers of these things to be honest, and will teach chemists, if they want encouragement, that the great Commonwealth of Massachusetts appreciates their endeavors, and all they have got to do is to come to Massachusetts and they will get their pay for those endeavors.

I have said all I intended to say; I have done my share, I think in the discussion of the subject of fertilizing material; I have tried to be as sensible as I know how. I have endeavored to escape any heresies, and shall be most happy if I have; and if I have contributed a single word to the interest of this meeting, I shall be more than satisfied.

Col. Wilder. It occurred to me, as Dr. Loring has recommended the purchase of ashes from the east, the west, the north and the south, whether we could find any one who would sell ashes. That is the trouble with me. I have sent to the State of Maine, and got some car-loads of ashes. Those cost me fifty cents a bushel, but I have found it very difficult to get them even there. I think it would be a very difficult thing to purchase any large quantities of ashes from any portion of our country. That they are the very quintessence of manure, for all purposes, no man can doubt. That our soils have been deprived of them, especially in the older portions of the country, is also undeniably true; and the potash can never be restored in quantities, except by the application of ashes, or by that fertilizer in some some shape or other. I should like to ask Prof. Goessmann if we can purchase potash by the cask, and use it instead of ashes.

I will state my own experience. You are well aware that I am not much of a farmer, but I had two little farms, and

in view of the difficulty of procuring ashes, I resorted to the expedient of buying potash, diluting it, and mixing it with meadow muck. I found it to answer a most excellent purpose.

Prof. GOESSMANN. Our commercial potash is undoubtedly a good material, but it is too expensive to buy. Besides, it requires very particular care to prevent its serious action on vegetable matter, as it is a very strong alkali. But as far as potash is the material wanted, I would recommend any neutral compound, like the Stassfurt compounds, as being cheaper, and being neutral compounds, either chloride or sulphide.

QUESTION. What is the comparative value of ashes worked in a high or low temperature?

Prof. GOESSMANN. Ashes produced by high temperature are liable to lose part of their potash, as, during the process of combustion, the carbon of the organic substance is reduced to potassium and rendered volatile.

Mr. TRASK. I want to ask the professor a single question. The question has been raised, perhaps, a thousand times, whether hard-coal ashes contain any plant-nutriment whatever. There are some gentlemen who have maintained that they do; but, although the question has been mooted a thousand times, it is not yet settled. Half the people of Fitchburg, perhaps, think to-day that there is some little virtue in the ashes of Lackawanna coal and the like. I should like to have the professor tell us whether there is or not any virtue in hard-coal ashes.

Prof. GOESSMANN. Hard-coal ashes contain a trace of lime, a trace of magnesia, and more or less oxide of iron and silicate of alumina. So far as the quantity of plant-food in hard-coal ashes is concerned, it does not amount to much. The effect of coal ashes is mechanical; it is an absorbent of ammonia, and therefore may make a new soil somewhat more retentive. There is scarcely a trace of potash in it.

Col. WILDER. Don't you find coal ashes very useful on stiff soil?

Prof. GOESSMANN. Under certain circumstances it might do. As a general rule, the heavy soils require the incorporation of dry organic substances, as turf, straw refuse, leaves,

and material of that kind, because, by their shrinkage, they render those soils porous, less retentive.

Mr. HUBBARD. Would not sand do just as well?

Prof. GOESSMANN. Undoubtedly, sand in clay soil would be an improvement, as it breaks up the retentive qualities of the soil, and renders it porous, permeable. A certain amount of sand is, in many respects, a great improvement to clay soil.

Col. WILDER. I think any gentleman, who will make the experiment, upon clayey, stiff, moderately strong soil, of planting a row of trees, without manure, in anthracite coal ashes, will satisfy himself that he has not only improved his trees, but also his land. He will find a very fine growth.

QUESTION. What is the relative value of leached and unleached ashes on soils?

Prof. GOESSMANN. The potash is extracted from leached ashes; they are worth something, but not by any means as much as unleached ashes, so far as the potash is concerned. If you want phosphoric acid alone, leached ashes would do as well as unleached; but, if you want potash and phosphoric acid, I should prefer to pay double the price for unleached ashes. It depends entirely upon what you want to apply to your soil.

Mr. GRAVES. I did not propose to take the time of this meeting, but I am so well pleased with Dr. Loring's remarks, they were so truthful, so fair, and so accordant with my own experience, that I must say a few words. I have experimented somewhat in the way he has suggested. I have several acres of land that have not been ploughed since 1837. I have a large muck-bed accessible, the bottom of it being hard almost as stone. Since 1837, I have drawn my manure to that muck-bed and mixed it at the rate of two load of muck to one of manure. I shovel that over two or three time previous to planting. I have applied this compost to this land for thirty-six years in succession, and I have got two crops from it every year without exception, usually cutting, the first time, fully two tons to the acre of first quality of hay, and about one ton the second time. I have tried it on heavy land and find that it is of no use; it is lost and worse than lost. I have tried it in its raw state, and, thus

placed upon land, it is worse than lost; but, if it can be neutralized, the acidity taken out of it by mixing it with manure, it is very valuable. Dr. Loring has expressed my mind so fully in regard to it, that I want to take him by the hand and thank him for doing so.

Mr. SESSIONS. I should like to have Mr. Knowlton relate his experience in regard to the application of coal ashes upon a gravelly knoll in raising rye. I am informed that he has left the city, and I will say that I visited his farm in October, and saw a piece of ground upon which a crop of rye had been sown the present fall, which looked well. He had raised a crop of rye for some six or eight years in succession on that piece of about one acre, and this crop had increased every year in quantity; and all the application he made to the ground was the coal ashes he made in his establishment.

Mr. TAFT. It should be said that Mr. Knowlton burns about as much wood as he does coal, and it all goes on that piece of land.

Mr. LEWIS. I want to take a little exception to my friend, Dr. Loring's, statement about muck. He is down on muck because muck has b en misapplied. I apprehend that if muck is put upon that soil to which it is adapted, it is of great value.

Dr. LORING. Will the gentleman excuse me one moment? I do not want any gentleman to say that I am "down on muck." We have reporters here, and it may get into the newspapers. I want to say distinctly, that I am *not* "down on muck." I go heart and hand with any gentleman here in the proper application of it. I want to have what I say properly stated, and properly and fairly judged. I repeat, I am not "down on muck"; I merely want to have it properly applied. I am only "down on muck" the same as I am "down" on sand, when it is applied in the wrong place.

Mr. LEWIS. That is all right, then; I will let that pass. But I am down on Dr. Loring for one suggestion he has made; and that is, that farmers should let those rascally, worthless fertilizer-men alone a year. That won't do. They will crawl out of this hole that Massachusetts has dug through the Hoosac, and come out of the big end of the tunnel in the

State of New York; and they will certainly demoralize all the honest men we have.

Mr. Root, of Barre. The discussion so far has related merely to those fertilizers which exist upon most every man's farm. No allusion, with one exception, I believe, has been made to what we may strictly call commercial fertilizers. In the able paper, which was presented yesterday by our worthy Secretary, you will remember the exorbitant sum which he stated was annually expended in the purchase of commercial fertilizers. Allusion has also just been made, in the report to which we have listened, to the expenditure of $200 or $300 a year in the purchase of commercial fertilizers. We farmers would like to know a little more about these fertilizers. For one, I make but little or no use of them. We cannot procure ashes enough, and we cannot find means at our own hand to make all the manure that we would like to use. We must have fertilizers; we cannot leap over a year. Now, if there is anything which is worthy of the confidence of the farmers of Massachusetts and New England, we would like to know what it is; we would like to know more about it. I would like, with your permission, to hear from a gentleman, a graduate of the Massachusetts Agricultural College, who, while under the instruction of Prof. Goessmann, gave a good deal of attention to commercial fertilizers, and since he graduated, two years ago, has given a good deal of practical attention to this matter. I refer to Mr. Bowker. I should be very happy for one to hear from him.

Mr. Bowker. I did not expect to be called upon, and I will tell you at the start, that I am interested in the manufacture and sale of commercial fertilizers. I have started the business, in connection with another gentleman, a classmate of mine, with the intention of selling to the farmers an honest article. One member of the Board of Agriculture, a good friend of mine, said to me, a year ago, "If you remain honest one year, you will do more than any other man who has gone into the business." Gentlemen, I believe my conscience is clear to-day, and I have been in the business one year. How much longer it may be so, I cannot say, but if my name is not advertised as being in the business, you may conclude

that I have gone out of it because it did not pay; because I could not manufacture an honest article and sell it at a profit.

Dr. Loring has referred to the fertilizer, which is being made at Brighton. It is the good fortune of myself and partner to be connected with that firm, as the sole agents of the fertilizer, and as the superintendents of its manufacture. The fertilizer is made, as perhaps many of you are aware, from the blood, the head-bones, the scraps and offal of the cattle and sheep slaughtered at that establishment, after the tallow is pressed from them. The works have been in operation about four months. They are now slaughtering from two hundred to three hundred head of cattle a day, and from fifteen hundred to two thousand sheep. And we should be pleased to show any farmer the whole process from beginning to end, or, if he desires, he can go there alone. He can see the ox as it comes into the stall to be killed; he can see his carcass hung up in the cooling-house; he can see his blood in a liquid form, and in five hours, he can see it brought out in the form of a dry, fine powder, and a better fertilizer was never put on our lands. Dr. Loring has said that much of this material was being sold to Southern manufacturers of fertilizers to be extended, and I will state that, we have sent one hundred tons to Georgetown, D. C., for which the manufacturer there paid us a good price; and out of every ton, he will make two or three tons of a fertilizer which he sells to go South. Now, we do not propose to do any such thing at Brighton. We propose to take the article as it comes out of the factory, and sell it directly to the farmers. One gentleman, a manufacturer from New York, said to me, "Why do you do that? It will kill everything the farmers attempt to raise with it." My reply was, "Farmers can extend it as well as we can."

Reference has been made to the Stassfurt potash salts. Undoubtedly, the Stassfurt salts are the cheapest source for potash in this market. We are mixing these potash salts with this fertilizer which is being made at Brighton, and it works very admirably indeed. The salts are neutral in their chemical action, and do not affect the fertilizer until they are moistened, and when moistened, then they act upon the bone, the blood and the meat, and hasten its decomposition;

making the fertilizer itself more available, and acting also as plant-food in the soil.

We do not treat the fertilizer being made there with any acid, and that brings up the question which I was in hopes Prof. Goessmann would allude to, namely, the use of superphosphates; whether we had better treat our bone with sulphuric acid, or use it in its raw condition. I am firmly of the belief that superphosphates are not of so much value as bone-meal. I believe I am taking a position a little in antagonism to that which our state chemist holds, and I have talked with him a good many times on the subject. It is true, gentlemen, that when you treat bone with sulphuric acid, you make it more soluble, but its solubility lies in the fact that you simply have more minutely divided it. Now, if you can take bone and steam it, grind it up, and reduce it to an impalpable powder, have you not accomplished the same thing, and also avoided the possibility of the destructiveness of sulphuric acid? Two years ago, a fertilizer manufacturer in Boston made a fertilizer on a very small scale, and attempted to make a very good one. He sent some of it to a friend of his in the suburbs, and he applied it to his soil. The result was it ruined his crop. It analyzed splendidly. He took the manufacturer down to his place and said to him, "There is my crop to which I applied your fertilizer,—what is the matter?" The man who applied that fertilizer knew what the matter was, and the manufacturer knew, also. It was too strongly compounded with sulphuric acid. Now, I firmly believe that many of the phosphates in the market have been injured by the addition of too much strong acid. At Brighton we are avoiding that. We take these large head-bones of cattle and sheep, and put them into a large iron digester, after the grease has been taken out of them. This iron digester is a large kettle or tank, in which is revolving an apparatus composed of iron tubes, and through these iron tubes, steam is passed under a pressure of sixty pounds to the square inch. These bones are put in and kept revolving under this high pressure of steam, for five or six hours. Then they come out the greater part in fine meal, much of it almost an impalpable powder. Some of the harder parts of the head, the teeth for instance, come out in

large lumps, but most of these lumps have been so thoroughly steamed that you can powder them yourselves between your fingers. We run these lumps through a burr-stone mill, and then mix the whole together. Now, by treating these head-bones under that high pressure of steam, we have accomplished what we should, if we had treated them with sulphuric acid, and, as I just said, we avoid the possibility of harm by using too strong acid in connection with our fertilizers.

I wish to refer once more to the Stassfurt potash salts. Our venerable friend, the Hon. Marshall P. Wilder, says that he believes in ashes. Undoubtedly, ashes are the best source of potash in the market. I believe every bushel of ashes contains about five pounds of potash. That potash is worth in the market to-day, at retail, ten cents a pound; therefore, every bushel of ashes is worth, for its potash alone, fifty cents. So every farmer should save his ashes; they are immensely valuable; they are worth more to him than they are to the soap-manufacturer. But if you cannot get ashes, as most farmers cannot, there are two grades of potash in Boston to-day, one containing sixty per cent. of sulphate of potash, which is being sold for two cents a pound. In every one hundred pounds, you buy sixty pounds of potash, and that brings your potash at three and one-third cents a pound; and you are buying a salt, the sulphate of potash, which is one of the best for agricultural purposes. Therefore, if the farmers of Massachusetts buy these Stassfurt salts, they are getting at the cheapest and best source of potash known in this country.

Mr. EVERETT, of Princeton. I hope we have been able to look an honest fertilizer manufacturer in the face for once, and I am sure we shall all patronize him. I think I shall, for one. I should like to know the gentleman's name.

The CHAIRMAN. He represents the firm of Bowker & Sparrow.

Mr. EVERETT. A friend here says he wants to know the price.

Mr. BOWKER. That is a very important matter. The price has been fixed at the rate of $50 a ton, for less than one ton; $47.50 a ton, for less than five tons; five tons, and

under ten, $42.50 a ton; ten tons and over, $40 a ton. Bear in mind, that to every ton of this fertilizer, we add from three to four hundred pounds of Stassfurt potash, giving about five or six per cent. of sulphate of potash, and two or three per cent. of what is known as oxide of potassium. A gentleman who is in this audience was in my office last week, Dr. Fisher, of Fitchburg, and he figured the value of that fertilizer from a chemical stand-point, taking the analysis which Dr. Goessmann had sent us, and I think he made it worth about fifty-three or fifty-four dollars a ton, taking the materials at the prices which are established by German chemists.

Mr. Lawrence. As we are talking about fertilizers, and as this seems to be a time when superphosphates have been found entirely wanting, and farmers are going into the dried-meat system, perhaps a few words from one who has been in the business of manufacturing fertilizers for some years may not be inappropriate.

I have been very much pleased with the remarks of the young gentleman, who has just taken his seat, with regard to the cost of commercial fertilizers. I have been in this business some seven years, and I do not believe that any man would dare to say to me, personally, that I am not an honest man; but it has become so fashionable lately, in every agricultural meeting, for somebody to denounce the phosphate-maker as a rascal, the phosphate-dealer as a scoundrel, and the man who uses phosphates as a fool, that a few words seem to be necessary upon this subject, which may have the effect to remove some of the impressions under which you are now laboring.

The truth of this matter is, that several years ago, the agriculturists of this country made up their minds that they could not get enough from their lands, by the use of such manures as they could make alone, to pay them for working their farms. As a matter of course, the scientific men of the country said, "We will help you out. We will give you fish guano; we will give you Peruvian guano; we will give you a fertilizer composed of hen-manure," etc. Finally, it got down to the manufacture of a manure which was called superphosphate of lime. A great many farmers bought it, and

I see men here to-day, who have bought it for years, and are entirely satisfied. From three to four per cent. of ammonia, and from seven to ten per cent. of soluble phosphoric acid have been the constituent parts of these fertilizers for some years.

From the speech of the gentleman who opened the discussion this morning, a man would naturally think that a party could not be engaged in the sale of commercial fertilizers, nor in the manufacture of commercial fertilizers, unless he was a rascal who ought to be sent to the penitentiary. Now, gentlemen, for aught I know, the manufacturers of commercial fertilizers are just as honorable men as any men in the community. Do we not find cheats in every trade; in the manufacture of cream tartar, of saleratus, in all the manufactures that are sold? And, to come a little closer home, gentlemen, do we not sometimes get cheated when we buy a load of wood, or when we buy butter or cheese? And now our good state legislature has come forward and given us a law which says we must put a label on our barrels, showing how much phosphoric acid and how much ammonia there is in our products. I can point you to three or four manufacturers, right here in New England, who have been putting such labels on their barrels for the last six years, and if you have been swindled, you have had the remedy before you all the time; a prosecution would have stopped us. We are just as liable to suffer for our criminality as any other set of men; there is no question about that. The law passed last winter simply effects what was effected before, and no more. As Prof. Goessmann says, the law allows him just about half the money for an analysis that it ought to allow. I know what it costs to make a proper analysis, but the law authorizes him to take only fifteen dollars. I do not find any fault with the law, gentlemen, but I do find fault with those men who come here and condemn every man who is manufacturing or selling a fertilizer. The manufacturer sells his article as an honest article, and if he sells a single pound that does not come up to his certificate, he is liable to punishment. I am very well acquainted with several of the manufacturers, and so far as I know, they conduct their business honorably. This young gentleman I am not acquainted with,

but I do not doubt he is dealing fairly. He and I would probably agree in regard to superphosphates, although we might differ in regard to the merits of dried beef.

QUESTION. What is the name of the gentleman's article?

Mr. LAWRENCE. Wilson's superphosphate, manufactured in Rhode Island. It contains $8\frac{3}{4}$ per cent. of ammonia, and 11.51 per cent. of phosphoric acid, 10 per cent. of which is soluble. Now, if any of you gentlemen are in the habit of working at figures, just make the calculation, and see how many pounds there are of acid, and how many pounds of ammonia, in a ton.

QUESTION. What is your price per ton?

Mr. LAWRENCE. We sell it at $79 a ton. It figures up forty cents a pound, commercially, not agriculturally, according to the best figures which we can get from Germany: $16\frac{3}{5}$ cents a pound for soluble ashes, $13\frac{1}{5}$ cents a pound for reduced ashes, and 7 cents a pound for potash,—although you cannot buy it for that money now. Nevertheless, as I have said, the fertilizer-men are cursed all the way through; and as I have a little English blood in my veins, and want to see fair play, I thought I would stand up here and make myself a target for all your eyes in regard to this matter.

And let me say, further, that, if men will study the principles of fertilization, if they will study their own manure-heaps, if they will study how to save their manures, both liquids and solids, as Dr. Loring says, and mix them all together, until they have got them into a proper condition for use, and then apply them to their soil, and mix them with the soil until every square foot of it has its fair proportion of manure, they can raise almost any crops they choose.

Now, I am acquainted with a farm of a thousand acres,—the soil is a loose, light, gravelly loam,—which is being worked right over every year. The proprietor of that farm, who knows four times as much as I do about farming matters, and, perhaps, twenty times as much, made up his mind that he must introduce some new elements into that gravelly soil. What did he do? He bought a muck swamp, took off the top and made peat of it, and then he went to work and took out a cord of the muck, and dried it a year; let it freeze and thaw until it was perfectly friable and easy to work,—no wa-

ter in it. He put that into a compost-heap, and mixed with it two hundred pounds of the superphosphate of lime which I have described to you to-day. The next spring, he thought he had a manure there that would raise rye, corn, oats, or whatever he wanted, on his gravelly soil. He spread it on, ploughed it under, harrowed the land well (for whatever he does, he does well), and the crops repaid him abundantly. He has been working in that way. There were potash salts in that gravelly land, but he could not get them, the rain would go down through and carry them off. So he went to work and put vegetable matter into his soil, to hold his manure, and then his crops grew; and I can show any man who will go down to Providence with me, as good a farm, out on old Seekonk Plains, as he would desire to look at, which has been artificially made to a large extent.

Now, to go back to the superphosphates a little. As this young gentleman has given me a fair opening by telling us what he is selling, I will tell you, as fairly, plainly and honestly as he has, how we make our goods, and leave you to judge for yourselves. The bones which we use are the refuse bones from a mill, which we use for another purpose. The bones are put into a retort, and burned in an open fire, thereby freeing all the ammonia. When the bones are taken from the retort, they are ground. They are then a white mass. They are then treated with sulphuric acid, enough to liberate the phosphoric acid, which we want for another purpose entirely. That is leached out, until there is only $4\frac{1}{2}$ per cent. of phosphoric acid left in the mass. It is then shovelled out and put one side. We also manufacture bone-coal, which gas and sugar refiners use, and about which we have heard a great deal said by this party and the other as to its not being good for anything. I will speak of that directly. In the manufacture of bone-coal, when the bones come out from the tight retort, which holds about six bushels, more or less, they come out in the same form in which they were put in, but entirely blackened. It is bone-charcoal; nothing more nor less. It then goes into the cracker, and is cracked into five sizes, which are sorted out into their various grades. Below that cracker, gentlemen, recollect we have a large amount of bone-charcoal dust. Now, what is that? It con-

tains all the phosphoric acid there was in the bones. The ammonia is gone; it has run off in the vapors that were thrown off by the action of the fire underneath, into a coil of pipes, and from these into a tank, where the bone-coal, and the ammonia with it, are treated with acid, and the sulphate of ammonia is precipitated to the bottom.

Now, I have shown you where we get three of the materials which go to make up the phosphates. If you have observed closely, you have noticed that these three materials are all of them waste materials, for the cost of all the other things that we manufacture is reckoned without reckoning that waste, and if we can sell that at a profit, we are lucky. Every manufacturer knows that if a man can get his waste products for nothing, it is so much added to his profits.

We have now three of the materials that go to make the phosphates. Now, we have a contract with the Providence and Pawtucket meat dealers, by which we obtain the offal from their butcher-shops. We have two car-loads of it every day. Well, what is that? It is the insides of cattle, sheep and hogs, and everything in the way of offal, and the hair. The hair is put one side, and sold as another merchantable article; the tripe goes to another place. The rest of this stuff is put into a rendering tank, sealed closely, and the tallow is rendered away; that goes to Liverpool. After we get that done the rest is concentrated right down, and treated with sulphuric acid, when it becomes a homogeneous mass, and then it is shovelled out one side. Then we have got another product.

We go another step. After we have used up all the bone we can for bone-coal, there still remain some bones, which are broken up, put into a vat, and steamed, with the steam at a high pressure. After they have been steamed a sufficient time, those bones become softened, to a considerable extent; the tallow is dipped off, and put away and sold in another place, and then the bones are in splendid condition to take the acid, which is run through the bones, and dissolves them.

Now we want to make the phosphate, and what do we do? We take a certain portion of this biphosphate of lime, which has been made by the action of the acid upon the bones; we add to this a certain portion of the biphosphate (I may call it

so) that is made by the action of acid on the meat; then we put in five hundred pounds of this refuse material; then two hundred pounds of sulphate of ammonia, and grind them all together. Allow me to say, that from a product of three hundred tons, five or six years ago, when I first went to the establishment, the production has increased to over four thousand tons.

Well, it is a hard matter if anybody, no matter what his professions of honesty and straightforward dealing may be, is liable to suspicion the moment he says a word in regard to commercial fertilizers. That is not as it should be. If one of you gentlemen come to me and show me an article that you have manufactured, and I know nothing about it, I take your word in regard to what it will do. I sometimes buy a horse. I do not know that I ever got worse shaved in my life than I have in buying horses. I would buy one that looked straight as a string—all right—but nevertheless, he had a strain running back to his father or mother, which, if I had known, I would not have paid fifty cents for him, when perhaps he cost me five hundred dollars. Is it right for me to say, therefore, that every man who has a horse to sell is a liar and a thief? Not a bit of it.

Now, I will go back to the system of frauds, if you please. Everybody has been cheated by these fertilizers, it is said, and the whole business is a fraud. I am going to show you that there is no fraud in the matter, and I will bring the state chemist to prove it. In the first place, I will take the price. I will take the last report of that gentleman, whom I honor. It has given me great pleasure to hear him speak, and if he has written a word that has got into print that I have not read, it is because I have had no opportunity to get it.

Capt. MOORE. I want to suggest that there are a number of gentlemen here who desire to speak on this subject, and I do not see how they are going to get a chance, if Mr. Lawrence keeps the floor.

Mr. LAWRENCE. I am a Massachusetts man; I never lived out of the State of Massachusetts in my life; and, assailed as the parties whom I represent have been, I do not think it is quite right for a member of the Board of Agricul-

ture to undertake to choke me off, when I have something to say.

The CHAIRMAN. You must allow me to say, that there has been no attempt to choke you off. You have occupied your full portion of the time. While I believe in free speech, I cannot allow the insinuation to be made, that there has been any attempt to choke you off. You have already occupied twenty-five minutes of the time.

Mr. LAWRENCE. It rather chokes me off, when I was about to speak on the point on which we have been abused. What I was going to say on the matter of fraud, was simply this: Prof. Goessmann, in his last report to the Amherst Agricultural College, has analyzed a number of phosphates. Now, compare the agricultural value, if you please, with the price in the market. I think he says Bradley's is worth $47 a ton. As a matter of course, we must add the price of the barrels, and the cost of transportation. I say nothing about our own article, because the gentleman gives us even more than we ever claimed, all the way through, as to money-value. He also gives an analysis of Mr. Russell Coe's superphosphate, and of Mr. E. Frank Coe's, and they do not either of them find a word of fault. We cannot see, to save our souls, where the matter of fraud comes in.

Mr. STRONG, of Newton. I feel that the result of this discussion will be to leave the impression that there is no help for the farmers of Massachusetts, except the exercise of their ordinary shrewdness in the matter of the purchase of superphosphates. It was said by Dr. Loring, in the early stages of this discussion, that, in his opinion, the time would come when superphosphates would take the place of animal fertilizers. I am not prepared to go as far as Dr. Loring; but I go so far as to say (and I think every one in the house will go as far as that) that this is an exceedingly important discussion, and I can understand why it was that, when Dr. Loring said that the farmer should refrain from the purchase of commercial fertilizers for one year, as the remedy for the evils under which they now suffer, our friend from Herkimer feared lest there should be a steady stream through the Hoosac to New York. But we are interested for another reason. I do not believe that this violent interference with

the law of demand and supply will work any reform for us. It does seem to me clear that experts are very much better able to determine the value of these fertilizers than the ordinary farmer. I know an expert is very much better able to do it than I am myself, and I feel that there is a vast amount of material in our Commonwealth that ought to be, and can be, utilized by our farmers, which has a value, and that value should be determined. Who is to determine it? We know that the farmer in past years has been cheated in the matter of these fertilizers. Who is to determine the value of anything of that description? Our chemists. For my part, I feel that it is exceedingly important that the farmers should sustain the present law, or, if they cannot do that, that some law should be prepared which shall protect us.

With regard to the fertilizer spoken of that is manufactured in the town of Brighton, possibly it is not necessary that that should be analyzed. It does seem as though that was from such pure sources that we could trust to its value, and I believe it is in the hands of such men, and that the association itself has such an interest at stake, that it will maintain its standard. And in regard to that, I wish to say, that I do not think there need be any apprehension that it will burn the crops. I have used the article upon pots in the greenhouse, and upon very delicate plants, and I find that it can be used in considerable quantities without danger of burning, as in the case of guano. I have used it with guano, when I have found the guano was destructive. I have also used it in connection with the Stassfurt salts, when I found the salts absolutely killed the plant, and the abattoir manure was a fine fertilizer. I have not used it on grass-land to such an extent as to be able to express an opinion as to its effect so positively as I could wish, but I have used it. I seeded down an acre and a half of land this fall to grass, and used about three hundred pounds to the acre, and I find the most admirable results; perhaps as fine a greensward as I have ever obtained by seeding in August, which is, in my judgment, the month of all months for putting in grass-seed.

My wish in rising was to express the opinion that this law should be sustained, or that the farmers should demand some law and some competent person to protect them in the pur-

chase of phosphates. I hope that the salary of the chemist, if he is retained in his office, will be so ample that he can afford to take pains and be thorough in his investigations, and that the farmer may be as well protected as the laws of Massachusetts can protect him, and I believe they can protect him.

Prof. STOCKBRIDGE, of the Agricultural College. I am well aware that this discussion, on account of time, must be soon brought to a close, notwithstanding the great interest that centres about it, and were it not that I am unwilling that it should cease, and no practical point of value to us or to the manufacturers of fertilizers be brought out by it, I would not impose upon you at this moment.

We are all agreed, everybody is compelled to be agreed, that if we are to support our present dense population, if we are to supply them with food from our soil, in its present condition, we must go outside of our home farm-resources to do it. Then we must agree that the business of manufacturing some kinds of fertilizers to go upon our lands is an essential, a necessary, an honorable, and should be a profitable, business. The farming of the United States up to this hour has not been a system of proper culture, but a system of spoliation, and our population in the future have either got to starve or we must adopt some other course.

Now, I know our friends Lawrence and Bowker well. I do not object to the complaint that they make here, that fertilizer manufacturers are everywhere denounced as dishonest men; but I tell you,—and they know it as well as I do, and I know it as well as the manufacturers do,—that we farmers have been most grossly imposed upon, jewed and cheated by fertilizer manufacturers. There is no mistake about it. Mr. Lawrence knows it, Mr. Bowker knows it, and we all know it.

Mr. LAWRENCE. Discriminate.

Prof. STOCKBRIDGE. Of course; I am going to say something more. I say, while that is a fact, there is such a thing as manufacturing an honest fertilizer. And another thing I know just as well as this, that not more than half the farmers, when they get hold of an honest fertilizer, know how to use it so that it shall tell honestly. That is a fact, too. We

want to take all these things into consideration. My friend Bowker and my friend Lawrence make pure superphosphates; they put in the requisite amount of acid. A farmer wants to buy something to make potatoes grow, and he goes to the manufacturer and buys a genuine phosphate,—nothing but sulphate of lime and phosphate of lime,—and it does not do him any good. He says at once, "The man who sold me that is a rascal." He was, perhaps, the most honest of men. The trouble was, the man applied a genuine phosphate to grow a crop to which it was not adapted. The farmer was more to blame than the manufacturer.

We want to take all these things into consideration. And remember this: there is no sort of confidence between these two elements. We want a hundred thousand tons of honest fertilizers used in America where there is one ton used to-day, and we can afford to do it if we can get an honest thing, and establish confidence between the manufacturer and the farmer. We want the farmer and the manufacturer to feel that their interests are identical; we want the article to use, and we want them to make us an honest article, and then we want to go forward and say that this question is of such vital importance, that it is the bounden duty of the government of the State or of the nation to oversee and superintend this business; that the government has a vital interest in it, and that, as they protect the health of our people by laws against the sale of unhealthy provisions, they should protect the pockets of our people, and secure crops for the country, by interfering in this matter in a proper manner.

Now, farmers and manufacturers, come together. Your interests are mutual. You manufacturers want to make an honest profit by making an honest article. We farmers want that article; but, in order to secure and keep this confidence, we want to put you under legal restrictions, so that we shall be sure of getting what we pay for. If we do not use it right it is our fault. We will try to protect ourselves up to that point.

This brings me up to the law. And here I think I shall agree with my friend Strong. We must have a law to give farmers confidence. We must have a law of such a kind, and so administered, that it shall control, not my friend

Lawrence, nor my friend Bowker, who are going to be just right, but the men who go into this business simply as a speculation, and do not care a penny what they sell you, provided they can make money out of it;—and there are lots of them, are there not, Mr. Lawrence?

Mr. Lawrence. That is true.

Prof. Stockbridge. It is true, and I know it. Now, we want a law, not for good men, but for evil-doers, because one evil-doer will do mischief enough in a county to prevent the use of these fertilizers, and so to cause a very marked deterioration in the quantity of the crops grown there.

Now, let Mr. Bowker and Mr. Lawrence, as the representatives of the whole fertilizer manufacturing community, go with us to the legislature, and we will get a law that shall be efficient, and hold you and us up to the mark. Does the present law do it? I have the law here. The first section of the law says that the fertilizer manufacturer shall put upon his bags, boxes or bales, whatever contains the material, the statement that this fertilizer contains so much potash, so much nitrogen, so much phosphoric acid, so much returned phosphoric acid, and the material from which it is made; but it does not state that the state chemist or inspector shall have any hand in this business. The manufacturer may go to any scalawag, and get an analysis for five or ten dollars, and put it on. The state inspector is not known in this operation at all. But by and by, after the manufacturer has put this analysis on, and sent his material out, this state inspector (a gentleman connected with the Massachusetts Agricultural College, I believe) is expected to go mousing around the Commonwealth, ferreting out as a detective, the frauds of these fertilizer manufacturers, and then come down on them and say, "Here, I have analyzed your fertilizer—give me fifteen dollars!" "Well," says the fertilizer manufacturer, "I shan't do it. I paid a chemist in Boston to analyze my fertilizer, and when you get fifteen dollars out of me, you will get it at the end of the law."

Now, I say, the law is defective in that respect. It was the best brother Moore could get, and he fought like a Trojan to get it last winter. I am glad that he got it, because it will serve as an entering wedge for a better law,

which I hope the Board of Agriculture will receive this winter. I hope they will not think it wicked to lobby at the state house until they drive out the herd who come there with their pockets full of money to lobby against the law, as a certain other herd were once driven out of the temple; and that the State of Massachusetts, remembering the sterility of its hills, and the vast number of people who ought to be fed from the products of its soil, will say, "This is a matter of so much importance that we will make a law that shall completely defend and protect our people in this respect, and we will have a state inspector who shall receive a salary from the Commonwealth, and not be compelled to go mousing around after these fertilizer manufacturers, to see if he cannot filch fifteen dollars out of their pockets, by analyzing a fertilizer which has been already analyzed. He shall come up to the dignity of a man; he shall have an office, and it shall be his duty as inspector to overlook the manufacturers of these articles, and say to them,—'This is to be made so and so; here is a paper to put upon your bag, or box, or bale, and it shall go out to the Commonwealth. Then, if I catch you adulterating these things, you shall pay a fine of fifty or a hundred dollars, and, finally, the state prison shall be your reward.'" It seems to me that this is a point we should make: that the state inspector must be a salaried officer, and receive such compensation for his services that Mr. Lawrence, or Mr. Bowker, or anybody else, cannot buy him up as the liquor-sellers buy up the police officers. Make him perfectly independent; then make the manufacturers pay a license to manufacture and sell, and let them tax us twenty-five or fifty cents or a dollar a ton more for their fertilizers, to get their pay.

Now, I appeal to you, gentlemen of the Board of Agriculture and farmers, if this would not be a sensible law? Could not we who use fertilizers afford to pay twenty-five or fifty cents or even a dollar a ton extra, if we could have confidence that this thing was managed right? Can you control the thing in any other or better way than that, by any sort of machinery? In order to do it you must amend the present law, retaining one or two features of it, and put such a public sentiment into the legislature this winter, that

the fertilizer manufacturers who feel so disposed may go there with all the money they are willing to spend in lobbying, and find in the end that they have made fools of themselves, wasted their money, and that the farmers have got such a law as they want, and will control it.

Adjourned to two o'clock.

Afternoon Session.

The meeting was called to order at two o'clock, Hon. James F. C. Hyde, of Newton, in the chair. Col. William S. Clark, President of the Massachusetts Agricultural College, read the following paper on

THE CIRCULATION OF SAP IN PLANTS.

The prime business of agriculture is to produce desirable plants in sufficient abundance, of the best quality and with the greatest economy. To do this with the highest success and with that rational intelligence which is generally supposed to be a distinguishing characteristic of the lords of creation, demands a knowledge of vegetable anatomy and physiology far more intimate and thorough than has ever yet been attained. To a superficial observer it might seem very easy to investigate, with the aid of all the appliances of modern science, such apparently simple and familiar phenomena as the germination of a little seed and the growth of a common tree. But the difficulties to be overcome in physiological researches, whether vegetable or animal, are so numerous and peculiar that real progress in knowledge is exceedingly slow.

In the year 1650, Dr. William Harvey, of England, the celebrated discoverer of the circulation of the blood, announced as the result of his studies in embryology that every living being originated from an egg. He had previously been physician to King Charles I., and when after the battle of Edgehill, in 1642, the royal party retired to Oxford, he is reported as having spent much time in observing the development of the embryo in eggs which were kept for the purpose under a sitting hen, in the college chamber of a friend. Since that time,

for more than two hundred years, this subject has received the earnest attention of enthusiastic and talented students in various countries, the most illustrious, of whom, our own colleague, has informed us that Professor Bischoff spent twenty years in observing the embryology of only four species of animals, and that he himself, with the ablest assistants, has devoted several years to the embryology of turtles. He has also stated that for one series of observations upon the changes occurring within a hen's egg during the first hours of incubation it was found necessary to open for examination three thousand specimens, and that so much talent, skill, time and apparatus are requisite for such investigations that almost nothing is yet known concerning the embryology of our domestic animals, the intelligent breeding of which constitutes a most important department of agriculture.

If now such well-nigh insuperable obstacles oppose inquiry concerning the changes which occur in the almost transparent gelatinous material of an egg, out of which the various organs and fluids of the complete animal are developed, we can hardly expect greater success when attempting to study the phenomena attending the reproduction and growth of plants. The hardness and opacity of the seed, the complexity of its chemical constitution and the exceeding simplicity of its cellular tissue, within whose secret chambers the processes of vegetation are carried on, all conspire to bewilder and discourage the investigator.

If two perfect fresh seeds from the ripe catkin of a willow be selected and placed, the one in warm damp earth and the other upon a shelf in a dry room, they will both change rapidly. The former, absorbing moisture and oxygen, within twelve hours begins to grow, the integuments burst and the young root emerges and strikes with unerring instinct into the moist soil, apparently under the influence of the force of gravitation. The plumule on the other hand struggles upward towards the light and air, and in opposition to the earth's attraction, rises toward the sky. This tendency of these two portions of every vegetable embryo to expand, the one into the earth and the other into the atmosphere, where each has its proper function to perform has been known as long as any botanical fact, but who can explain it? While under the genial

influence of moisture, oxygen and warmth the first seed has been thus changing into a young willow, the other though appearing unaltered to the eye has been rapidly losing its capacity for germination and if at the end of a fortnight it be planted in the most favorable circumstances for growth, it will merely absorb water and then speedily decay. All that the wisest botanist can tell us in explanation of these phenomena is that the first seed was alive and that the other was dead, though no violence had been done to it and no appreciable chemical change had affected it. Why one seed dies in twelve days and another retains its vitality unimpaired for many years, are equally mysteries yet to be solved.

The young willow under kindly influences will increase in size and weight daily until the chilling winds of autumn breathe upon it. Then the leaves fall, growth ceases and the plant enters upon a period of repose similar in many respects to the hibernation of animals. This annual cessation of the vital action in plants appears to be essential to the health of most species, though a few, like the orange and lemon, do not require it. In cold climates, the absence of heat in winter, and in warm latitudes, the want of water during the periodical dry season, are the principal causes which operate upon vegetation to enforce this law of nature.

The distinction between deciduous and evergreen species is, that the former lose their foliage at the end of the growing season, while the latter retain each perfected leaf one, two or three years. Nevertheless, evergreens usually have their time of rest no less than deciduous plants, and those which are deciduous in one climate may become evergreens in another. Thus the apple and the plane-tree have become evergreens in Madeira.

Professor Hofmann made a series of experiments from 1863 to 1870 to determine whether this annual period of rest was really necessary for ordinary plants. He found that when the lilac and other similar species were forced under glass to grow continuously by the constant presence of heat, light, moisture and proper soil, they ceased to blossom after the first year, and died on the second or third. Hence the importance so well known to skilful gardeners of giving alternations of heat and cold, moisture and drought to plants

cultivated under glass during their proper seasons of activity and repose.

The difficulty often experienced in getting flowers from specimens of cactus and other house-plants by persons who, being ignorant of these facts, carefully water them alike at all times through the year, is thus readily explained. The plants, having no opportunity to ripen their tissues, can never be in condition to blossom.

After the fall of the leaves and the ripening of the wood and buds, the stem and branches of most trees and shrubs will be found upon examination to be unusually dry and free from sap, and it has been said that this was an indication of hardiness. That most of our indigenous species assume this condition during about one-half of the year is doubtless true, but the presence or absence of sap cannot be considered as conclusive evidence of tenderness or hardiness. The grape-vine appears quite porous and free from sap in December, but is often winter-killed. On the other hand the sugar and silver-leaved maples are usually full of sap on some days of every month in the year, and yet are perfectly hardy.

The curious facts that the Indians used to make maple-sugar in November, that good sap-days may occur during any time between the first of October and the first of May, that the flow of sap varies remarkably during the ordinary sugar season according to the weather, and that the percentage of crystallizable cane-sugar in the sap of the same tree is also subject to extraordinary fluctuations in different years and in different months of the same season, render the *Acer saccharinum* or sugar-tree of North America, a species of peculiar interest to the inquiring botanist. While we know that every tree of our forests produces a little sugar of some sort at some period of its growth, usually at germination, at flowering, and in fruit, we have not learned why the maples alone produce cane-sugar in sufficient quantity to render its extraction profitable.

Stimulated by the desire of some further and more definite information upon these points, and by the hope of adding at least a little to the general stock of human knowledge we instituted a series of observations at the Massachusetts Agricultural College in the spring of the present year, and arrived

at some results which seem to be new and important. The amount of mental and manual labor involved in such investigations, even after a statement of the facts, can hardly be appreciated, except by those who have been engaged in similar work.

The task of making, adjusting and repairing six mercurial gauges used in determining the pressure exerted by the sap of different trees, and the recording of most of the observations, was cheerfully undertaken and most faithfully performed by Prof. S. H. Peabody, who also prepared with great skill a chart representing upon a uniform scale the results of all the observations. He visited every gauge under his charge from three to six times every twenty-four hours for several weeks. All of them were necessarily at considerable distance from his residence, and one was reached by a perpendicular ladder forty-two feet in height, so that taking observations, especially in dark and stormy nights, was far from a pastime.

Prof. Levi Stockbridge recorded with great care and interest the fluctuations in the mercury in the gauge upon the sugar-maple during a period of ninety days.

Prof. C. A. Goessmann took the specific gravity of a large number of specimens of sap from many species of trees, and from the same trees at different times, and applied chemical tests for the determination of sugar and other ingredients.

Mr. Albert T. Wakefield, of the senior class, devoted much time for some weeks to tapping the various trees of the forest, collecting specimens of sap for analysis, and weighing the daily flow from the several trees under observation. As these were widely scattered over the College estate, their visitation necessitated a somewhat extended journey at a season when people generally do not walk the fields for pleasure.

When it is further added that over sixty species of trees and shrubs were tapped, most of them several times, and that the extreme points where observations were made were more than five miles apart, some conception may be attained of the labor required for the acquisition of these few facts.

In order that the results of our investigations may be more fully appreciated, and the questions involved more clearly apprehended, it seems necessary to discuss briefly the general structure of plants and the numerous theories which have

been adduced concerning the circulation of sap, and the mode of vegetable growth.

The simplest and minutest of plants consist of single hollow globules of vegetable membrane, in which no pores nor openings of any sort can be detected by the most powerful microscope. These globules are often so minute as to be individually undistinguishable by the unaided eye, and yet are so numerous as to give their color to large expanses of snow, on which they flourish, or to water which is inhabited by them. These globules are called vegetable cells, and such plants are unicellular. In most species, however, the mature individual, while always originating from a single embryonic cell, consists of innumerable cells aggregated into some characteristic form. Thus, among the fungi we have species of mould which are unicellular, and single puff-balls containing thousands of millions of cells.

When vegetable cells are thus crowded together, they become variously modified in form, and while in the lower orders they remain entirely closed and disconnected, except by the cohesion of their imperforate membranes, in the higher orders, as in our common trees, they are often converted into continuous tubes by the absorption of the intervening partitions. These tubes are always formed parallel with the axis of growth, and, along with woody fibre, constitute what may be styled the warp of all timber. The woof, running from the centre to the circumference of every woody stem, contains only flattened, imperforate cells. These are always present and often very abundant, and constitute what is known to mechanics as the silver grain of the wood of maple, beech, and other so-called exogenous plants, to which, for the sake of brevity and clearness, this discussion will be confined.

When ordinary cells are united into a more or less extended structure, they constitute what is known as cellular tissue. This may be soft and pulpy, as in the flesh of an apple, loose and tender, as in the pith of an elder, firm and tough, as in birch-bark, or hard and brittle, as in the shell of a hickory-nut or the stone of a peach.

The tissue of the inner bark, consisting of very long and narrow cells overlapping each other at the ends, is called

bast, and that of the stem, in which the cells are similar but shorter, is called woody fibre. The tubes, which are formed as already described, are styled ducts or vessels, and, as they are mingled with woody fibre in the annual growth of timber, the ordinary combination of these is named fibro-vascular tissue. When these elongated cells and ducts are straight and parallel, as in the chestnut, the wood of which they are the warp splits easily, but when they are interlaced and blended irregularly, the longitudinal grain of the wood will resemble that of the elm.

Every seed and every young plant consists wholly of cellular tissue, but with the development of leaves is combined the growth of fibro-vascular tissue. The first vessels to appear in the plantlet are arranged in a circle around a column of tissue, which remains loose and soft, and after the first season dries up and dies. This is called the pith and seems essential to the life of every woody stem and branch during its infancy, although its special function is unknown. Between the vessels around the pith may be seen the rays of cellular tissue which ultimately become hard and firm, and which unite in bonds, never broken except by some external force, the inside of the stem with the outside of the bark. These rays make up the woof and have much to do with the distinctive peculiarities of different sorts of timber.

Immediately outside the vessels enclosing the pith grows a layer of woody fibre, upon which, in a more or less developed state, according to the season, is a layer of organizable material, called cambium, which may be regarded as the seat of life in the plant.

Next to the cambium, and united to the wood by the rays from the pith, is the bark, consisting of three layers. The inner or fibrous layer is formed by bast cells and firm cellular tissue. In plants with a milky juice this layer is permeated by irregular reticulated canals called the laticiferous or milk-bearing vessels. What service these vessels or their contents render to the growing plant is unknown. The milky fluid, however, often furnishes to man some valuable product. Thus the milk of the several species of cow-tree is a nutritious and agreeable beverage, that of the poppy-head yields opium, and the juice of several tropical trees supplies the

world with caoutchouc, gutta-percha, and other useful gum-resins.

Surrounding the inner bark is a layer of cellular tissue in which the rays from the pith terminate, and which is named the green layer, because it often exhibits this color in young shoots, and then performs the same functions with the green tissues of the leaf. Outside of all is the corky layer, consisting of dry, dead cellular tissue, and developed annually from the green layer. This is not usually of much thickness or consequence, but sometimes, as in the cork-oak of Spain, it becomes an important article of commerce.

The growth of our trees goes on in the cambium layer, from which is produced annually a layer of wood and a layer of bark, each formed of longitudinal fibro-vascular tissue and horizontal cellular tissue. As the trunk expands the outer bark cracks and falls off, as in the shag-bark hickory, or distends and envelops it with a somewhat smooth covering, as in the beech and birch. In these latter cases, the annual cortical layers are quite thin, and the outer layer very gradually wastes away under the influence of winds and storms. In the cork-oak the outer layer is specially thickened, and, if removed every eighth year, may be obtained in stout, elastic sheets, which would crack and fall to the ground in the process of time, if not harvested.

The structure of the root is not unlike that of the stem, except that the pith is usually wanting, as well as the green layer of the bark, which could not be formed, nor be of any use in the dark earth where the root makes its home. This part of the plant develops an annual layer of wood and bark with rays of cellular tissue like the stem. The number and extent of root-branches in the soil depend much upon its fertility and adaptation to the plant. Thus, Hellriegel found that a plant of barley, in a rich, porous soil, had one hundred and twenty-eight feet of roots, while a similar specimen in coarser and heavier land had only eighty feet. He also measured the roots of winter-wheat, rye and clover, and learned that they penetrated the earth from three to four feet. As the vigor of vegetable growth depends chiefly on the action of the roots, the importance of thorough tillage is apparent. With the present enormous cost of fertilizers it

may be wise to revert to the idea of that famous pioneer in agriculture, Jethro Tull, who believed that manure might be profitably superseded by suitable mechanical means for pulverizing and aërating the soil.

The striking peculiarity in the structure of the root is the absorbent power of the young rootlets, which are either covered with a thick spongy layer of cellular tissue, or furnished, as is commonly the case, with exceedingly minute but innumerable hairs, which penetrate the crevices of the earth in every direction in search of food. The extreme tips of the rootlets, about one-sixth of an inch in length, are not clothed with hairs, nor capable of absorption, but serve as entering wedges for the advancing root, which lengthens only near the extremity. The bark of the larger roots becomes thick and impervious, like that of the trunk and its older branches, and the inner portion of the wood both above and below ground gradually solidifies, and becomes unfitted for the free transmission of fluids. It is then called heart-wood in distinction from the sap-wood through which fluids are transmitted freely. The farther any layer of wood or bark is removed from the living cambium, the less vitality does it retain, and consequently the less useful is it in the economy of the plant.

The leaf has been said with some propriety to be an expansion of the bark, and consists of a frame-work of fibro-vascular tissue forming the stalk and veins, with a double layer of loose cellular tissue covered with a distinct epidermis or skin. The vessels in the leaf-stalk and the veins, which are its branches, are also in two layers, the upper connecting the leaf with the vessels surrounding the pith, which are called spiral because of their peculiar markings, and the lower which are united to the cambium layer through the tissue of the inner bark. The leaves of a singular plant called *Hermas*, in South Africa, have the two layers of the leaf so loosely attached that they readily separate, except where united at the edges.

The distinctive feature of the leaf is the presence of stomata or breathing pores, which are usually most numerous on the under side. The leaf of the lilac has none on the upper surface, but the surprising number of one hundred and sixty

thousand on every square inch of the lower. These stomata are furnished with openings so constructed as to close in very dry air and open in that which is moist, but they always remain shut except under the stimulus of light. As the chief function of the rootlets is to absorb the liquid food of the plant from the earth, so it is the special work of the stomata to transpire the surplus water of the crude sap, which has been employed as a carrier of food from one extremity of the countless series of cells which build up the plant to the other, in some cases a distance of five hundred feet through imperforate membranes and against the force of gravitation.

In regard to the size of vegetable cells it is difficult to obtain a correct conception, unless one is familiar with the use of the compound microscope. The spores or reproductive cells of some fungi, like the black smut on wheat, are so minute that eight millions of them placed side by side would only cover one square inch of surface. In every cubic inch of maple-wood there are probably not less than one hundred million cells of the various tissues. The average diameter of ordinary plant-cells is less than one four-hundredth of an inch, and even the ducts or continuous tubes are not usually much larger, and are often smaller than this. Professor Gray informs us that sap must pass through two thousand partitions in every inch of bass-wood through which it rises. If the cells of the gigantic gum-tree of Australia are as small as this, then a drop of sap must permeate about twelve millions of membranous walls in passing from the rootlet by which it is absorbed to the topmost leaf by which it may be exhaled.

The vegetable kingdom has been created for the evident purpose of establishing perpetual harmony between the mineral kingdom on the one hand and the animal kingdom on the other. Plants produce all the food and all the vital air which are indispensable to animals. Every growing plant may be regarded as a machine for converting mineral matter into cellulose, gum, starch, sugar and the various albuminoids by the digestion and assimilation of which animals live and grow. Every thriving plant is also exhaling continually, under the stimulus of sunlight from its myriads of stomata, pure vapor of water and oxygen gas, and we have often

wished that once at least in every summer these inestimable blessings might become visible as they rise in beautiful though unseen forms and mingle with our atmosphere. On that occasion surely, thoughtless and ungrateful men would be constrained to admire the wonderful works of the Creator.

The chemical elements of plants and animals are of course identical. Three are very common in all organic tissues,—carbon, oxygen and hydrogen,—and three more are found wherever there is life, though usually in very small quantity,—nitrogen, phosphorus and sulphur. Besides these there are a few metals which are essential to the growth of healthy and perfect plants. Thus iron in very minute proportion is found in the green coloring matter, or chlorophyl of every plant, and chlorophyl may be regarded as analogous to the gastric juice of animals, since without it plants are incapable of digesting carbonic acid, or elaborating cambium, or other organizable matter. Potassa, lime and magnesia are also necessary ingredients in the food of all plants, and though they are scarcely to be regarded as constituent parts of any vegetable tissue or product, they are absorbed by the roots, circulate in the sap, and are probably deposited in all cells, since a greater or less quantity of incombustible ash remains whenever they are burned. Their presence doubtless aids in the formation of vegetable acids and other compounds, and assists in the transference of elaborated or assimilable materials from one part of the plant to another. A few other elements are taken up in variable quantities by living roots, but can hardly be considered as deserving of attention at this time.

It is a fact worthy of special notice that the amount and kind of mineral matters absorbed by a growing plant may be caused to vary greatly by artificial treatment, and Professor Goessmann has shown, in his report on the sugar-beet, for 1871, that this plant exhibits remarkable changes in its ash-constituents, as well as in its percentage of sugar, as the result of cultivation. The ash of the wild beet contains more soda than potassa, but the best and sweetest sugar-beets now contain at least three times as much potassa as soda. As a soda plant therefore it was worthless, having scarcely a trace of sugar, but the physiological changes produced by artificial

treatment have made it one of the most valuable of agricultural plants, yielding a juice with from twelve to fifteen per cent. of cane-sugar. There is every reason to believe that the flavors of fruits and the most desirable qualities of all the vegetable products of the farm and garden may be thus improved and controlled by the intelligent use of fertilizers, and this consideration adds practical importance to the study of vegetable physiology. We all know that whenever a hive of bees find themselves without a queen or royal eggs they at once proceed to develop a common egg into a royal larva by feeding it with a peculiar food. Is it unreasonable to hope that we may learn how to modify as radically the nature and qualities of plants by a similar process?

The food of plants consists chiefly of carbonic acid gas, and is absorbed from the air by the green parts, which, like the leaves and young bark, contain chlorophyl, and are furnished with stomata. More than half the weight of ordinary dry vegetable matter is thus derived from the atmosphere. It may aid to fix this fact in mind, to consider that there is constantly floating in the air, over every acre of the earth's surface, seven tons of carbon which, if precipitated at once as lampblack, would be likely to leave a permanent impression. Yet the proportion of carbonic acid in the atmosphere is only one part in twenty-five hundred by measure. The question naturally arises whether plants would not grow faster if furnished with more of this food. Experiments have shown that in sunshine they can digest a more concentrated carbonized air, but that such air exerts a deleterious effect at all other times.

Water is the most important of the remaining constituents of plant-food, and in the liquid form is wholly absorbed by the rootlets, though aqueous vapor must under some circumstances be imbibed by other vegetable organs. The elements of water, oxygen and hydrogen, are united with carbon in the same proportion in which they exist in this fluid in the living cells, principally of the leaf, to form the common material of vegetable tissues called cellulose and several other substances having nearly or precisely the same composition, but different properties and uses. These are mainly starch, gum, and several varieties of sugar, which, by the vital ac-

tion of plants, are transformed one into the other or into cellulose, according to the requirements of the vegetable economy. Only a small portion, however, of the water taken up by the roots is assimilated, much the largest part being exhaled by the leaves. It performs, nevertheless, most valuable service as a common carrier throughout the various parts of plants, both of those nitrogenous and other substances absorbed in very dilute solution from the soil, and of those organic compounds formed within the plant, and essential to its growth in the several stages of its development.

The vital fluid, corresponding to the blood of animals, and existing in every young and growing vegetable cell, is called protoplasm, and is a somewhat viscid substance, containing, in addition to carbon, oxygen and hydrogen, nitrogen, sulphur and phosphorus. Other similar substances are laid up in the seed in a more concentrated and permanent form for the sustenance of the young seedling at the period of germination. As the herbiverous animals can derive their nitrogen, sulphur and phosphorus from no other source than these so-called albuminoids of plants, and as ripe seeds can rarely be obtained in sufficient quantity for their exclusive support, it is interesting to observe that they are generally formed for the consumption of large quantities of tender herbage, which is easily digestible, and contains these essential elements of their nutrition in a very dilute form in the protoplasm of the growing cells.

Vegetable growth is an increase in size and weight in consequence of the multiplication and enlargement of cells, and occurs chiefly in the vicinity of the cambium layer which, in the growing season, envelopes every living root, stem and branch, and penetrates between the two layers of every leaf. The mode of cell development has been carefully studied with the aid of the microscope, and may be best observed in aquatic plants with large cells, or in transparent hairs, such as are often found on the leaves or flowers of plants in dry situations.

The protoplasm in aquatic cellular plants is usually thin and colorless, and encloses a minute globule called a nucleus, which often contains still more minute nucleoli, together with

granules of chlorophyl. The contents of each cell exhibit a motion in one or more currents around and within its membranous wall, and in the case of adjoining cells, the currents usually move in opposite directions on opposite sides of the intervening partition. In the protoplasm of hairs there is often less freedom of motion from an apparent lack of fluidity, and the currents appear to move to and from the nucleus which lies against the cell wall. This kind of motion is called rotation, and seems to result from an inherent vital property of protoplasm. It is thought to occur in all cells during some period of their growth.

The so-called zoöspores, or motile germs, of some algæ consist of a globule of protoplasm furnished with two or more delicate arms or cilia, which revolve continually in the water for an hour or more after being ejected from the parent cell, and appear as if endowed with the animal power of voluntary locomotion. Soon, however, the protoplasm begins to lose its mobility, settles quietly to the bottom, develops upon itself an enclosing membrane, and becomes a complete plant.

There are two principal modes in which cell multiplication is effected; but in all cases it originates in the protoplasm or vital fluid. In simple cellular plants it is common for the protoplasm to gather itself into two or more portions within the parent cell, and develop a nucleus and membrane for each. These young cells then grow by the assimilation of food, burst or absorb the membrane of the original cell, and become independent plants.

In the growing cells of all our higher plants a very different process is observed. The protoplasm first begins to contract in the central portion of the cell, and either divides the nucleus, or develops a new one for the cell about to be formed. Each portion then secretes a new membranous covering, and enlarges it by an inexplicable method called intussusception of molecules, and the newer cell then repeats the process, while the older one, having attained its normal size,, remains *in statu quo*. Thus the plant goes on increasing in all directions, wherever the necessary conditions are supplied, until it reaches maturity. Annual and herbaceous plants do this in one season, biennials in two, and

perennials continue for an indefinite but variable period, according to the nature of the species.

We are now prepared to consider the subject of the circulation of sap in the entire plant, involving two topics about which there have been much controversy and speculation, and too little observation and true philosophy. The first relates to the ascent of what is styled the crude sap, which enters at the root, and rises against the force of gravitation to the topmost leaf of even the tallest tree. The other has reference to the return of the so-called elaborated sap from the leaf to the root, so as to complete a true circulation.

Many have said there is no such thing as a general circulation of sap; but no one doubts the fact of an upward flow from the roots, and a vast exhalation of water from the foliage, during the period when the vital forces of the plant are active. It is also universally admitted that the cells containing chlorophyl are the organs in which the elements of the carbo-hydrates are combined, and from which, therefore, they must pass by some channel to all other parts of the plant, where either growth occurs or amyloid substances are stored up for future use. Whether the albuminoids are formed also in the cells of the leaf or are the result of combinations occurring in the cambium between the soluble carbo-hydrates and the ingredients of the crude ascending sap is not certain, and has no necessary connection with this discussion. The distinguished botanists who have devoted themselves to the study of vegetable structure and physiology have generally erred in one of two directions. Some have attempted to reduce the phenomena of plant-life to systems of their own invention which were the results of imperfect and partial botanical observations and a limited knowledge of the collateral sciences of chemistry and physics, while others have endeavored to explain all the mysteries of the vegetable organs and their functions by the general application, without the *experimentum crucis* of the various principles of science which are known to govern the changes occurring in dead matter.

Thus Coesalpinus, without possessing any definite knowledge of organography or chemistry, regarded the pith as the seat of life and the source of all the veins through which circulation went on, while the leaves he thought to be chiefly useful

as a protection for the tender buds and fruit against the burning rays of the sun.

About two centuries ago, the general structure of plants was carefully studied and in many respects accurately described by the celebrated anatomists, Grew and Malpighi, yet having no knowledge of chemistry and but little of animal physiology, they reasoned incorrectly concerning the functions of the several parts.

The earlier botanists very naturally regarded the root, the stem and the leaf as the vital organs of the plant, and ascribed to them certain functions. Thus Theophrastus said the root was the stomach of the plant, designed to take up nourishment, and Malpighi compared roots to hands, which in the absence of the power of locomotion were extended for food. Linnæus also regarded them as the mouths through which the plant was nourished.

In like manner, the function assigned the stem was simply to convey the food absorbed by the roots to the parts above it and that of the leaf to exhale or perspire surplus moisture, just like the skin of animals. After the discovery of the atmospheric gases, about the beginning of the present century, it was found that the leaf inhaled carbonic acid and exhaled oxygen, which was regarded at first as a sort of respiration, and this function was then added to that of perspiration.

These half-truths of science concerning vegetables were accepted as satisfactory for a time. It was found, however, that a fragment of a leaf or the cutting of a stem or a root could readily be made to produce buds and perfect plants; that a plant might be inverted and its branches become roots, while the former roots put forth leaves. Hence it became evident that these were not true organs, with special functions, like the lungs and stomach of animals, but were of a complex nature, with various and, under some circumstances, interchangeable offices.

The earlier physiologists, like Perrault, Duhamel, Knight and De Candolle, were impressed with the idea that some kind of circulation was necessary for the distribution of nutriment to the several parts of the plant, but they were unable to devise any theory for the explanation of all the phenomena of growth. There has been a prevalent idea, however, for more

than a hundred years that the crude sap ascends in the wood, especially in the sap-wood, and that the elaborated sap descends in the bark. This seemed to be proved by the fact first observed by Magnol, that colored liquids absorbed by plants rise unchanged through the wood, but not through the bark, and also by the fact that if a ring of bark be removed from a growing stem, it ceases to increase below the ring, but forms a swelling at the edge of the bark above the ring. It was observed also that the bark of those trees which, like the birch, bleed freely from a fresh wound in the wood in spring, is always at this season comparatively dry and free from sap.

Knight experimented upon the potato-plant, and discovered that when a ring of bark was removed from the stem no tubers were formed under ground, or below the ring, but small tubers appeared in the axils of the leaves above the ring, and the plant remained fresh and vigorous, and when the axillary tubers were taken off, blossomed and bore fruit.

Further proof of the downward, or rootward, tendency of the elaborated sap is seen in the effect of ringing a fruit-bearing branch of a grape-vine or pear-tree, by which the fruit is increased in size through the abundance of nutriment which under ordinary circumstances would descend to the lower part of the plant.

Professor Rainey, of London, describes an interesting experiment, performed by him on some young lilacs, which seems to prove conclusively that the crude sap rises in the wood, and the perfected sap, which is essential to the life of the plant, descends only in the bark or the cambium layer just beneath it, and that it is incapable of penetrating the sap-wood or any other tissue. He selected four shoots or sprouts of a similar character, and around three of them he wound firmly a coil of copper-wire, but without breaking the bark. This was in December, 1844. In the spring of 1845, all four of them expanded their leaves at the same time, and continued through the season equally healthy. One of them was now cut for examination, and exhibited a layer of wood and a layer of bark of the usual thickness above the ligature, while below, the layers, though visible, were very thin. The next spring, 1846, the two remaining shoots put forth their

leaves at the same time as the other lilacs and continued to flourish till autumn. After the fall of the leaves, another one was cut for examination, and it was found that a second layer of wood and bark had formed as far down the stem as the wire, where it was somewhat enlarged, and that no growth whatever had taken place below this point. In the spring of the third year, 1847, when the lilac buds began to swell and the foliage to develop, the buds on the third specimen which had been selected for experiment suddenly withered, although they had appeared as plump as usual up to this time. In June, 1847, this shoot was cut and examined. The wood below the ligature appeared brown and dead, and had received no addition the previous year, while the part above the wire was fresh and green and had formed a new layer of wood and bark the preceding season.

This seems to demonstrate that the cambium layer is the seat of life, and that whenever the direct communication between the root and the foliage is cut off in this layer during one entire season of growth, the whole plant perishes.

It has also been determined by experiment that if several rings of bark be removed from a growing shoot in such a manner that on one of the isolated sections of bark there be no leaf, while leaves remain on others above and below this, then the leafless section will fail to make any growth in any part. All the other sections, if furnished with one or more healthy leaves, will increase in thickness by the formation of new layers of wood and bark. This again seems to prove that the material for growth is elaborated by the leaves and is transmitted only through the cambium and has no power of penetrating the tissues of the wood.

The peculiar vital and organific power of the cambium is remarkably illustrated in the structure and growth of grafted trees. Every person is aware that pear-trees are grown upon quince-roots, and that they often bear finer fruit than when cultivated as standards. This is doubtless owing to the fact that quince-roots, being diminutive, furnish less water to the leaves, which thus elaborate a richer sap and produce more perfectly developed wood and fruit.

The apricot may be grafted on the plum, and the peach on the apricot, and the almond on the peach, and thus we may

produce a tree with plum roots and almond leaves. The wood, however, of the stem will consist of four distinct varieties, though formed from one continuous cambium layer. Below the almond wood and bark we shall have perfect peach wood and bark, then perfect apricot wood and bark, and at the bottom perfect plum wood and bark. In this curious instance we see the intimate correspondence between the bark and the leaf, for if we should remove the almond branches we might cause the several sorts of wood to develop buds and leafy twigs each of its own kind. Each section of the compound stem has its seat of life in the cambium, and the cambium of each reproduces cells of its own species out of a common nutrient fluid.

Thus there is seen to be a flow of crude sap upward in the wood, and a flow of organizable material essential to the life of the plant, proceeding from the leaf to the root through the bark and cambium layer. From this perfected sap the growth of the season is formed, and provision for the beginning of the next season's growth is also stored up, commonly in the root. As the fact of a rootward flow of elaborated sap is very generally denied at the present time, it may be well to quote a single line from the edition, published in 1870, of the admirable text-book on botany by the late Professor Henfrey, of London, which has been carefully revised by Dr. Masters. In reference to this subject he says, "The evidence of a descent of elaborated sap is overwhelming." There is then a peculiar motion or circulation of the fluid contents of every living cell, called cyclosis or rotation of sap, and there is a general movement of fluids upward and downward in the entire plant, which may be named circulation of sap. The upward flow is vastly greater and more rapid than the downward, but the motive power in all three of the cases specified is unknown, except we rest satisfied with the old-fashioned and, to some persons, unphilosophical, but nevertheless real and most wonderful power called vital force, which in the living vegetable cell subordinates all other forces.

Numerous hypotheses have been advanced to account for the circulation of sap through the operation of some merely

chemical or physical forces, but their very multiplicity exposes their unsatisfactory character.

Grew, in his "Anatomy of Plants," gives an illustration to explain the ascent of sap, which reminds one of the attempt of a man to lift himself over a fence by pulling on his boot-straps. He represents a number of cells surrounding a tube or duct, and states that water, being absorbed by the cells, passes into the duct to a given height. The cell membranes then swell so as to compress the duct, which forces the water a little higher. It now passes out into the empty cells above those first named, their walls are swollen by the absorption of the fluid, the duct is again compressed, and so on to the top of the tree.

Malpighi was of the opinion that the contraction and expansion of air in the ducts under the influence of heat and cold pumped up the sap, but this could not be without valves to obstruct its reflex action which do not exist, since they cannot be found and since willow or rose cuttings will grow as well with one end up as with the other. Moreover, at the period of greatest pressure, there is often no air in the tree, but every cell and duct is gorged with sap, as has been fully shown in the experiments at the College.

De Saussure gratuitously supposed the sap-vessels to be endowed with a capacity for contraction and dilation under the influence of appropriate stimulants, and thus to force up the fluid, which had been absorbed by the ordinary imbibition of the spongy rootlets.

Knight, without any good reason, assumed the pith-rays, extending from the centre to the circumference of the stem, to possess irritability, and by their contraction and expansion to compress and dilate alternately the fibro-vascular tissue and so cause it to act somewhat like a force-pump.

Du-Petit-Thouars, rejecting all mere physical forces, advanced the hypothesis that the original force is a vital one, but that in the spring, after a period of repose, the buds, under the influence of the sunshine, begin to expand and by the absorption of sap, which they exhale, create a vacuum or suction which puts the fluids in motion throughout the entire plant. Exhalation and chemical changes, then occurring, keep up the flow till the fall of the leaves in autumn. This,

however, entirely fails to account for the familiar fact that the sap is often pressing into trees, like the birch, with tremendous force, several weeks before there is the slightest activity in the buds.

Dutrochet discovered the principle called osmose, which causes unlike fluids separated by a thin septum to flow together with different degrees of rapidity. Thus, if a solution of sugar be separated, by a thin membrane, from pure water, the water will pass through into the sugar freely while a minute portion of the sugar will enter the water, the result being a large increase in the volume of the sugar solution. This force, under favorable circumstances, will overcome the force of gravitation so as to cause the rise of water in a tube to a considerable height.

Professor Graham has more recently investigated this subject and learned that dissimilar fluids and gases have a tendency to mingle their molecules, and to do so with some freedom through permeable septa in accordance with the law of osmose. He has divided all soluble substances into two classes, namely, crystalloids and colloids. The former, like common sugar and salt, diffuse themselves readily through solvent fluids and membranous partitions, while the latter, like glue and starch, are, comparatively, non-diffusive.

The general principle of osmose has been almost universally adopted, without any considerable attempt at demonstration by physiological experiments, as the chief cause of all the motions which occur in the contents of vegetable cells, such as the absorption of water by the rootlets, the ascent of the crude sap to the leaves, and the general transference of all nutrient matters to the parts where they are deposited and assimilated.

There are many difficulties in the way of accepting this charmingly simple hypothesis. Among these may be named the fact that there are found in the different adjoining cells of plants entirely distinct substances which do not mingle, as in the brilliant petals of flowers, where superimposed layers of cellular tissue contain fluids of unlike colors. The cambium, also, which evidently does not penetrate the sap-wood, readily finds its way through hundreds of feet of its proper conducting medium. Again, the organic contents of plant-

cells are almost exclusively colloids, and the proof of their easy and rapid transmission through imperforate membranes is yet to be discovered; neither is there sufficient evidence of any such exudation of organic matter from the rootlets, where osmose is imagined to occur, as is required by all that is known of this principle in its operation upon lifeless matter.

Ordinary absorption and capillary attraction have been thought to assist in producing the phenomena of the motions of sap, though no one regards them as sufficient of themselves, since they not only lack the requisite power, but also that peculiar ability, manifested by the living plant, to select from the soluble materials of the soil just those substances which every species needs for its peculiar constitution.

Herbert Spencer has attempted to demonstrate that the compression and dilatation of cells and ducts, caused by the swaying of stems and branches in the wind, is an important aid in promoting the flow of sap. When we consider that many trees grow where the wind scarcely affects them, and that plants flourish in glass-houses, where they are never disturbed in this way, we shall see that this hypothesis is of small account. There is also here, as in the hypothesis of Malpighi, a need of valves to prevent regurgitation, and we have, during the present season, demonstrated that detached living roots, entirely underground, exert an enormous force merely by their power of absorption.

After this general discussion concerning the circulation of sap in plants, we are prepared to consider in a very brief manner the results of a few experiments instituted for the purpose of asking the trees a few questions which the books did not satisfactorily answer.

The earliest investigations in this direction of which we have a record were begun about the year 1720, by Rev. Stephen Hales, an English clergyman, and published in a volume entitled, "Statical Essays, containing Vegetable Staticks; or, An Account of some Statical Experiments on the Sap of Vegetables; being an Essay towards the Natural History of Vegetation. Of use to those who are curious in the Culture and Improvement of Gardening, &c., &c."

For the first experiment described, he took a flower-pot in which was growing a sun-flower, three feet and a half in

height, and with a leaf-surface of thirty-nine square feet, and covered the top of the pot with sheet-lead, into which he inserted a narrow glass tube, to admit air, and a wider one stopped with a cork, through which he watered the plant. This pot he weighed every morning and evening for fifteen days, and as there was no way of escape for the water poured into it, except through the absorption of the roots and the exhalation from the leaves, he learned that the average amount exhaled per diem was one pound and four ounces, or about one ounce of water for two square feet of leaf-surface.

Similar experiments with other plants showed that a cabbage exhaled in proportion to its surface nearly twice as much as the sun-flower, or one ounce for each square foot, and that a grape-vine exhaled less than the sun-flower, and less than most other plants. Hence the vine rarely suffers from drought.

He then fastened a branch of spearmint into an inverted syphon, and poured in water so that the cut end of the branch was immersed in it. He found that exhalation and absorption proceeded so as to lower the fluid very perceptibly in the open arm of the tube.

Another experiment had for its object the determination of the force with which the root of a growing tree would absorb water. For this purpose he attached a glass tube to the end of an amputated root half an inch in diameter and, having filled it with water, placed the open end of the tube in a dish of mercury. In six minutes so much water had been absorbed into the tree as to raise the mercury to the height of eight inches.

In order to determine whether water would enter and permeate an inverted branch through the small end, Mr. Hales, having sealed the large end of an apple branch with foliage upon it, cut off the tip and immersed it in water. The fluid passed freely to all parts of the branch, so that the leaves remained fresh, and in three days exhaled more than four pounds of water.

The fact that sap would flow freely either way through a root was shown by laying bare a large root of a tree having a sucker growing upon it, and removing that portion of it between the sucker and the earth, preserving the portion between it and the tree. The sucker continued to flourish,

drawing its sap readily through the other roots of the tree, instead of directly from the earth as before.

Having observed that a grape-vine which had been cut in the spring was bleeding abundantly, and fearing it would be injured, he attempted to stop the flow by tying a piece of bladder over it. Seeing this was forcibly distended, he attached a tube to the stump of the vine to learn how high the sap would rise against the force of gravitation. It soon ran over the top of a tube twenty-five feet high. He then applied mercurial gauges to several different vines, and obtained, as the maximum pressure exerted by the rising sap of the grape-vine during the bleeding season, a force sufficient to sustain a column of mercury thirty-eight inches in height, which is equal to a column of water forty-three feet high.

Nearly all modern books on vegetable physiology, in whatever language printed, have given the result of Hales' experiments as the maximum pressure attained in observations upon the ascent of sap, and the grape-vine has been generally regarded as an exceptional plant in this particular, and thus a kind of stumbling-block in the way of speculating physiologists.

To learn how far this might be true, and what were the facts concerning the spring flow of sap in our forest-trees, and especially in the sugar-maple, in regard to which scarcely any accurate observations had been made, we began some investigations at the Agricultural College last March, the results of which may be summarily stated as follows:

The great majority of trees and shrubs do not bleed from wounds at any season of the year, and the few species in our latitude which exhibit this phenomenon at all do so only when deprived of their foliage. No peculiarity of structure or habitat has yet been detected to account for this extraordinary difference among them. The soft and spongy wood of the willow or the elm, which often grow in moist ground, might be deemed specially suited to absorb and pour forth water before the expansion of their leaves or flowers in spring, but the wood appears to contain scarcely any sap at that time. Of more than sixty species of trees and shrubs, tested by boring a three-quarter inch hole usually to the depth of two inches into the sap-wood near the earth, only

those of the following genera showed any tendency to bleed, viz.: *Betula*, which includes the birches; *Acer*, the maples; *Vitis*, the vines; *Ostrya*, the hornbeam; *Juglans*, the walnuts. The genus *Carya*, to which belong the hickories, sometimes exudes a very little sap, and possibly the *Fagus* or beech, and *Carpinus*, the hop hornbeam, may do the same, though no opportunity offered for testing them satisfactorily. On the 19th of March, when the ground was still covered with snow, but free from frost, fourteen species of the common forest-trees were tapped, and nearly all the species brought under observation were tapped, first on the 21st of April, and again on the 30th of the same month.

It was discovered that each species of those which flowed had its own time of beginning, when it seemed to awake from its winter's repose; that the flow steadily increased in quantity and force, as indicated by the weight of sap and the pressure on a mercurial gauge, until it reached its maximum, and then gradually declined; and that the composition of the sap of the several species differed remarkably, according to the date of the flow and especially the time of its beginning.

This singular periodicity, peculiar to every species, demonstrates that the absorption of water by the rootlets is not caused by osmose, or any other mere physical force, but is the result of the specific life, which imparts to every plant its distinctive characteristics.

The sugar-maple begins to flow in October, reaches its maximum about the first of April, and ceases about the first of May.* The black birch begins to flow the last of March, attains its maximum the last of April, and stops about the middle of May. The wild summer grape-vine commences about the first of May, arrives at its maximum of flow and pressure about the 20th of May, and ceases early in June.

This difference in the season of flowing is, of course, accompanied by a corresponding variation in the temperature of the soil and the atmosphere, and very naturally also in the chemical composition of the sap. Thus the principal ingre-

* Mr. H. S. Goodale, of Mount Washington, Mass., a member of the Board of Agriculture, states that he has made maple-sugar from sap collected in the months of October, November, January, February, March, April and May.

dient of maple sap is cane-sugar, that of birch sap is grape-sugar, and that of vine sap is mucilage or gum.

These three carbo-hydrates, cane-sugar, grape-sugar and gum, are doubtless chiefly formed out of the starch which has descended to the root of the plant as the result of the previous season's growth. It seems probable that these transformations occur in the sap after the period of activity begins and in the following order, viz.: Insoluble starch, whether deposited in the cells of the root or previously transferred in solution to those of the stem, and there stored during the period of repose, becomes soluble gum, gum becomes uncrystallizable grape-sugar, and this under favorable circumstances becomes cane-sugar. Why then do we find cane-sugar in the maple and not in the birch, and why only gum as the chief ingredient in the sap of the vine, and of those trees which do not acquire the power of active absorption until the development of their buds? Probably because these transformations require time, and the maple alone is gorged with sap during the six months intervening between the fall of the leaf and the beginning of growth in the spring. This affords ample time for chemical changes, and seems to have some connection with the fact that the maples are the only trees from which crystallizable cane-sugar can be profitably extracted.

For a similar reason, since we find the birches filled with sap for several weeks before a bud begins to expand, we may reasonably expect the formation of grape-sugar at least in them, and in the north of Europe a sweet syrup is obtained by the evaporation of their sap.

The spring sap of the vine at the beginning of its motion, about the first of May, contains no sugar of any kind, but three weeks later it often acquires a sweetish taste and then we may find a trace of grape-sugar. At this period the beginning of vegetable growth is attended by the rapid exhalation of the water of the crude sap, and the assimilation of its gum, in the formation of cellulose, and this is precisely the transformation which ordinarily occurs in plants at the beginning of the vegetating season.

In regard to the circumstances which affect the flow of sap from the sugar-maple, the following results have been arrived at. A careful comparison of the daily weight of sap

from several trees with the meteorological observations of the same period, conclusively proves that while the general flow corresponds with the season, rising to a maximum and then declining, yet the daily and hourly flow varies with the weather. The most unfavorable weather is that which is either steadily and severely cold, or uniformly warm and foggy, while the best sap days are such as are bright and warm at mid-day, but preceded by freezing nights. Such variations of temperature as affect the flow of maple-sap are most likely to occur when the ground is covered with snow, because the heat of the sun during the day cannot then accumulate to moderate the cooling influence of the night. The most probable explanation of the effect of these alternations appears to be that the outer tissues of the tree are partially emptied of their contents by the contracting influence of cold, the sap being driven into the heart-wood of the trunk and large roots. Meanwhile absorption goes on as usual underground, and thus, when the outer layers of the wood are expanded by the heat of the sun, the sap rushes back to the surface and flows abundantly.

Observations by Biot, in France, on the poplar, and by Nevins, in Ireland, on the elm, seem to show that the sap is thus forced by freezing weather from the outer wood and branches into the heart of trees.

To determine whether sap would flow from the heart-wood of a sugar-tree, a piece of gas-pipe was sharpened and driven snugly into a hole six inches deep. From this spout the flow was regular and long-continued, but not quite so abundant as usual. This proves that the spring sap does enter and fill the heart-wood as well as the alburnum under some circumstances.

Another tree was selected and a piece of bark five inches long and two inches high was removed from the outer layer of wood, and a piece of sheet-iron driven into the bark below to catch the sap, which flowed very profusely, but stopped very early. The tree, from the heart of which sap was taken as above described, flowed eleven days longer than the similar one from which only a piece of bark was removed, but the latter afforded twelve pounds more sap than the former.

In the case of a tree tapped on the north and south sides at the same level, it was found that the north spout yielded daily about twice as much sap as the south spout, and continued to flow nearly two weeks longer. The tree was tapped March 19th, and produced seventy pounds of sap, containing two and one-half pounds of sugar. The maximum flow from this tree occurred March 23d, and amounted to ten pounds three ounces, from two spouts.

In order to discover whether the sweetness of the sap was the same in all parts of the tree, a spout was inserted into a healthy maple, which had never been tapped, at the usual height, and fifty feet above this another spout was set into the trunk, where it was about five inches in diameter. A limb thirty-five feet from the ground was also cut off where it was one inch in diameter. In seven hours the lower spout had bled six pounds of sap, the limb two ounces, and the upper spout not a drop. Similar experiments on different trees showed that the sap flowed most freely within twelve feet of the earth, and that the flow diminished rapidly above this height.

Experiments upon the roots of maples proved that sap flowed from both ends of a cut root, and that it all contained sugar.

While the average annual yield of ordinary trees in a sugar-orchard is about sixty pounds of sap and two pounds of sugar, a tree in Leverett is reported to have produced in one season fourteen hundred pounds of sap, which probably contained more than forty pounds of sugar.

There seems to be no good evidence that the bleeding of trees or vines has any appreciable effect upon their growth or health. It is certain that maples have been tapped every year for fifty years without diminution of their sugar-product, or perceptible injurious consequences of any sort.

The birches appear to exceed all other trees in the amount of sap which they yield and the enormous pressure which they exert upon the gauge. Four species, the black, the yellow, the paper and the gray or white birch, were tapped and the daily flow of sap weighed. They were all tapped March 19th, but did not bleed till the 25th, from which time they flowed

with regularly increasing amounts till they reached the maximum of about fifteen pounds from one spout per diem for each species. This was the last of April, soon after which the leaves began to expand and the flow to diminish.

The hornbeam did not flow when tapped April 21st, but on the first of May bled about ten pounds of nearly tasteless, turbid sap. On the third of May, it reached its maximum of twelve pounds and six ounces from one spout, and slowly declined in amount after this date.

The wild vine afforded from a single spout eight ounces of nearly tasteless, limpid sap, May 26th, which was the largest amount for any one day, and bled through the entire month of May a few ounces daily.

It only remains to state in a few words some of the surprising results obtained by the application of mercurial gauges to the sugar-maple, the black birch and the grape-vine. Observations were made on one or more gauges several times daily and occasionally every hour of the day and night, from the first of April to the 20th of July.

A gauge was attached to a sugar-maple March 31st, which was three days after the maximum flow of sap for this species, so that further observations are required earlier in the season to complete the record and determine with certainty the maximum pressure which it exhibits in spring. Of the record made, the following facts are specially interesting. First, the mercury was subject to constant and singular oscillations, standing usually in the morning below zero, so that there was indicated a powerful suction into the tree, and rising rapidly with the sun until the force indicated was sufficient to sustain a column of water many feet in height. Thus at 6, A. M., April 21st, there was a suction into the tree sufficient to raise a column of water 25.95 feet. As soon as the morning sun shone upon the tree the mercury suddenly began to rise, so that at 8.15, A. M., the pressure outward was enough to sustain a column of water 18.47 feet in height, a change represented by more than 44 feet of water. On the morning of April 22d the change was still greater, requiring for its representation 47.42 feet of water. These extraordinary fluctuations were not attended by any peculiar state of

the weather, and happened twelve days before there were any indications of growth to be detected in the buds. These observations are quite new and as yet wholly inexplicable, but will receive further attention at a future time.

The maximum pressure of the sap for the season was observed at 10, A. M., April 11th, and was equal to sustaining a column of water 31.73 feet high. This was an excellent sap day, considering the lateness of the season. There was noticed a general correspondence between the flow of sap in other maples and the pressure on the gauge.

After April 29th, the mercury remained constantly below zero, day and night. During the month of May, there was a uniform suction equal to about eight feet of water, and the unaccountable feature of this fact is that though apparently produced by exhalation from the expanding leaves, it remained the same, day and night, for several weeks. In June, the suction gradually lessened and finally disappeared, the mercury standing steadily at zero.

The fact that exhalation from the leaves of growing plants would cause suction capable of holding up several feet of water was discovered by Hales, but has no apparent connection with these phenomena.

On the 20th of April, two gauges were attached to a large black birch, one at the ground and the other thirty feet higher. The next morning at 6 o'clock, the lower gauge indicated the astonishing pressure of 56.65 feet of water, and the upper, one of 26.74 feet. The difference between the indications of the two gauges was thus 29.92 feet, while the actual distance between them was 30.20 feet, so that they corresponded almost precisely as if connected by a tube. In order to learn whether the same principle would prevail, if the upper gauge was moved, it was raised twelve feet higher. The same correspondence continued through nearly all the observations of the season, notwithstanding the gauges were separated by 42.20 feet of close-grained birch-wood.

At 12.30, P. M., April 21st, a hole was bored into the tree on the side opposite to the lower gauge, and at the same level. Both gauges at once began to show diminished pressure, while sap issued freely from the orifice. In fifteen minutes, one

pound of sap having escaped, it was found that both gauges had fallen equal to 19.27 feet of water. Upon closing the hole the gauges rose in ten minutes to their previous level, showing that the rootlets had re-absorbed in that brief period the sap which had escaped from the tree, notwithstanding the enormous pressure already existing.

A stop-cock having been inserted into the hole opposite the lower gauge, it was found that the communication between it and both the gauges was almost instantaneous, which shows that the tree must have been entirely filled with sap to the height indicated by the column of mercury in the lower gauge, which exerted its pressure in all directions as freely as if standing in a cylindrical vessel as large as the bark of the trunk.

The sap pressure continued to increase until, on the 4th of May, it represented a column of water 84.77 feet in height, which is believed to be the highest pressure of vegetable sap ever before recorded.

The buds of the birch now began to expand, the pressure of the sap to diminish and the oscillations of the mercury to become more decided and regular than before. The upper gauge ceased to vary May 14th, remaining stationary at zero. The lower one declined slowly and varied greatly, but did not fall below zero until May 18th. On May 27th, it also became stationary at zero. The suction manifested by the birch was very little, never exceeding nine feet of water, and continued only for a few days.

To determine if possible whether any other force than the vital action of the roots was necessary to produce the extraordinary phenomena described, a gauge was attached to the root of a black birch-tree as follows. The tree stood in moist ground at the foot of the south slope of a ravine, in such a situation that the earth around it was shaded by the overhanging bank from the sun. A root was then followed from the trunk to the distance of ten feet, where it was carefully cut off one foot below the surface, and a piece removed from between the cut and the tree. The end of the root, thus entirely detached from the tree, and lying in a horizontal position at the depth of one foot in the cold, damp earth, unreached by the sunshine, and for the most part unaffected by

the temperature of the atmosphere, measured about one inch in diameter. To this was carefully adjusted a mercurial gauge, April 26th. The pressure at once became evident and rose constantly with very slight fluctuations until at noon on the 30th of April it had attained the unequalled height of 85.80 feet of water. This wonderful result showed that the absorbing power of living birch rootlets, without the aid of any of the numerous helps imposed upon them by ingenious philosophers, such as osmose, exhalation, dilatation, contraction, oscillation, capillarity, &c., &c., was quite sufficient to account for the most essential of the curious phenomena connected with the circulation of sap. Unfortunately, in an attempt to increase the capacity of the gauge, the bark of the root was injured, and this most interesting experiment terminated. There can be little doubt that future trials, carefully conducted, with suitable apparatus, will achieve still more marvellous results.

The original experiment upon the grape-vine, the story of which has come down to us through a hundred and fifty years, was repeated May 9th, and a pressure of 49.52 feet of water obtained May 24th. This is six and a half feet higher than was observed by Hales.

The peculiar features of the pressure of the vine sap are: its lateness in the season; its apparent independence of the weather; its uniform and moderate rise day and night to its maximum; its very gradual decline to zero, without any marked oscillations; and its constant and almost unvarying suction of 4.5 to 6.5 feet of water, manifested from June 20th to July 20th, when the observations ceased.*

In conclusion, we may as well admit that life is still a special force and not to be resolved into any other sort or combination of attractions or repulsions, whether called electricity, osmose or any other name. There is obviously need of much more investigation and definite knowledge concerning the phenomena of vegetable nutrition and development and it

* Prof. A. N. Prentiss, of Cornell University, states that he has found in Brazil certain trees which, during the dry season, when transpiration from the foliage is very great, would suck air into a wound made in the trunk by the stroke of an axe so forcibly as to cause a sound, amounting almost to a groan.

may be well to remember that we are everywhere surrounded by objects for scientific research demanding our utmost talent, patience and skill, but sure to give ample and profitable results to every diligent inquirer. We are often inclined to encourage ourselves to remain in ignorance and idleness by dreaming of grand opportunities for study in some far-off time or place, but let us all keep in mind the fact, so familiar to every thoughtful student of nature, that within the limited circle of our vision lie concealed more mysteries than with our best endeavors we can ever solve.

Observations on the Pressure of Sap.

The following tables show the maximum and minimum pressures, with the time when each occurred, as indicated by the several mercurial gauges attached to the species named. The pressure is given in inches of mercury, which may be changed to feet of water by multiplying the number of inches of mercury by 13.6 (its specific gravity), and dividing the product by 12, to reduce inches of water to feet.

The black birch is *Betula lenta;* the sugar maple, *Acer saccharinum;* and the vine, *Vitis æstivalis.*

The birch was a fine, sound forest-tree, six and one-half feet in circumference, and seventy feet in height. The maple was a healthy shade-tree, sixty feet in height, and five feet in circumference. The vine was a vigorous wild summer-grape, and the gauge was applied to a branch near the ground. The main stem was four inches in circumference, and the branch about two and one-half inches.

The birch-roots were entirely detached from the tree, and were about three inches in circumference at the large end, where the gauges were attached. The root No. 2 was not tested until No. 1 was injured, and the greatest pressure for the season was past.

In the table for the black birch, the first or upper figures for each day are the observations on the upper gauge, and the next line gives those of the lower gauge. The distance between the gauges was first 30.20 feet, and afterward 42.20 feet, the upper gauge having been raised 12 feet April 25th.

SUGAR MAPLE.

DATE.	Time of Minimum.	Minimum.	Maximum.	Time of Maximum.
1873.				
April 1,	6.30 A. M.	0.	8.8	2 P. M.
2,	7 "	— 1.2	0.9	11 A. M.
3,	12 P. M.	— 1.	3.6	10 "
4,	6 A. M.	— 1.8	8.6	11.30 "
5,	8 P. M.	— 4.	11.2	6 "
6,	12 A. M.	— 1.8	2.7	12 M.
7,	12 "	2.6	5.9	5.30 P. M.
8,	6 "	4.1	15.7	3 "
9,	6 "	2.9	5.1	2 "
10,	5 "	2.4	14.2	12 M.
11,	5 "	— 5.2	28.	10 A. M.
19,	10.30 P. M.	— 8.2	9.3	9.30 "
20,	12 A. M.	— 7.	10.8	11 "
21,	6 "	—22.9	16.3	8.15 "
22,	6 "	—19.9	22.	9 "
23,	12 P. M.	— 5.8	11.2	12 M.
24,	6 A. M.	—16.2	0.2	6 P. M.
25,	6 "	—10.	2.1	9 A. M.
26,	6 "	— 5.8	1.7	9.30 "
27,	6 "	— 3.2	5.8	9.30 "
28,	12 P. M.	— 7.6	— 1.	12 "
29,	5 A. M.	—11.2	5.2	12 P. M.
May 1,	5 "	—10.	— 0.7	7 "
4,	6 "	— 9.1	— 2.8	6 "
5,	6 "	— 6.3	— 2.9	6 "
12,	6 "	— 7.7	— 7.3	6 "
18,	6 "	— 8.2	— 8 2	6 "
21,	6 "	— 8.4	— 8.1	6 "
24,	12 A. M.	— 5.0	— 3 6	2 "
29,	6 "	— 1.6	— 1.2	7 "
June 1,	6 "	— 2.6	— 0.8	6 "
6,	6 "	— 0.3	0.9	11 A. M.
16,	6 "	— 0.9	— 0.9	6 P. M.

BLACK BIRCH.

DATE.	Time of Minimum.	Minimum.	Maximum.	Time of Maximum.
1873.				
April 21, Upper gauge,	7.30 P. M.	22.1	33.	11.30 A. M.
21, Lower "	7.30 "	46.7	59.3	11.30 "
22,	9 "	25.5	30 9	5.30 "
22,	9 "	51.9	54.9	5.30 "
23,	8 "	23.3	33.4	7 "
23,	8 "	49.7	59.2	7 "
24,	7 "	14 6	31.7	1 P. M.
24,	7 "	51.7	57.8	1 "
25,	9.30 "	16.5	22 6	7.30 A. M.
25,	9.30 "	53.3	60.3	7.30 "
26,	12 A. M.	18.3	25.3	9.30 "

Black Birch—*Continued.*

DATE.	Time of Minimum.	Minimum.	Maximum.	Time of Maximum.
1873.				
April 26,	12 A. M.	55.4	62.5	9.30 A. M.
27,	9.30 P. M.	21.4	27.2	7.30 "
27,	9.30 "	58.4	64.8	7.30 "
28,	8.30 "	20.5	31.	8 "
28,	8.30 "	57.5	67.8	8 "
29,	3.30 "	17.7	32.5	8.30 "
29,	3.30 "	54.4	71.	8.30 "
30,	9.30 "	22.3	33.5	12.30 P. M.
30,	9.30 "	58.4	70.	12.30 "
May 1,	6.30 "	10.	37.	9.30 A. M.
1,	6.30 "	46.4	73.2	9.30 "
2,	12 M.	16.	31.	7.30 "
2,	12 "	52.	67.1	7.30 "
3,	12 "	27.4	32.6	9.30 "
3,	12 "	63.6	68.7	9.30 "
4,	9.30 P. M.	10.	37.8	8 "
4,	9.30 "	45.8	74.8	8 "
5,	9 "	— 8.2	38.7	9.30 "
5,	9 "	28 6	74.3	9.30 "
6,	6.30 "	—15.1	30.3	10.30 "
6,	6.30 "	25.3	66.6	10.30 "
7,	3 30 "	—13.5	–	10.30 "
7,	9.30 "	8.1	48 3	12.30 P. M.
8,	2.30 "	— 4.5	–	12.30 "
8,	9.30 "	8.5	49.6	9.30 A. M.
9,	12 A. M.	1.8	4.8	12 P. M.
9,	12 "	12.8	38.5	12 "
10,	9.30 P. M.	— 4.	13.2	3.30 "
10,	9.30 "	33.8	50.7	3.30 "
11,	12 A. M.	— 2.	6.8	12 30 "
11,	12 "	35.	42.5	12 30 "
12,	3.30 P. M.	— 4.2	17.6	7.30 A. M.
12,	9.30 "	5.9	52.1	9.30 "
13,	12 "	1.5	2.4	11 "
13,	9.30 "	3.	37.2	12.30 P. M.
14,	9.30 "	0.	0.	12 30 "
14,	9.30 "	0.7	23.3	12.30 "
15,	9.30 "	0.	0.	3.30 "
15,	9.30 "	— 1.6	11.2	3.30 "
16,	6.30 "	— 0.4	19.2	12.30 "
17,	9.30 "	— 5.6	16.	8 A. M.
18,	6.30 "	— 8.2	13.1	8 "
19,	6.30 "	— 1.2	6.3	7.30 "
20,	2.30 "	— 1.1	4.9	7.30 "
21,	12.30 "	0.	1.7	7.30 "
22,	12 30 A. M.	1.8	8.8	1.30 P. M.
23,	1.30 P. M.	— 0.1	2.6	12 A. M.
24,	12 A. M.	0.4	0.6	12 P. M.
25,	12 "	0.6	0.	6 "
26,	6 "	0.2	0.3	6 "
27,	6 "	0.	0.	6 "

BLACK BIRCH-ROOT—No. 1.

DATE.	Time of Minimum.	Minimum.	Maximum.	Time of Maximum.
1873.				
April 26,	12 M.	46.	64.3	9.30 P. M.
27,	7.30 A. M.	56.8	65.6	12 "
28,	1.30 P. M.	65.9	69.	11.30 "
29,	12.30 A. M.	68.4	74.	12 "
30,	12.30 "	74.	75.7	12.30 "

BLACK BIRCH-ROOT—No. 2.

DATE.	Time of Minimum.	Minimum.	Maximum.	Time of Maximum.
1873.				
May 2,	7.30 A. M.	9.7	13.8	12 P. M
3,	12 "	13.8	20.	12 "
4,	12 "	20.	29.8	12 "
5,	12 "	29.8	39.	12 "
6,	12 "	39.	44.2	6.30 "
7,	3.30 P. M.	40.7	43.6	12 "
8,	12 A. M.	43.6	44.4	12 "
9,	10 P. M.	41.	41.4	12 A. M.
10,	6.30 "	40.5	41.0	12 "
11,	12 "	37.7	40.4	12 "
12,	12 "	32.2	37.7	12 "
13,	12 "	27.1	32.2	12 "
14,	12 "	23.2	27.1	12 "
15,	12 "	19.7	23.2	12 "
16,	12 "	16.6	19.7	12 "
17,	12 "	14.2	16.6	12 "
18,	9.30 "	12.	14.2	12 "
19,	9.30 "	10.7	14.	7.30 "
20,	6.30 "	8.5	11.	7.30 "
21,	6.30 "	7.5	10.8	7.30 "
22,	6.30 "	9.	14 6	7.30 "
23,	1.30 "	8.5	10 2	7.30 "
24,	12 "	5.9	9.2	12 "
25,	6.30 "	5.	5.8	12 P. M.
26,	6.30 "	3.8	7.3	7.30 A. M.
27,	7.30 "	3.6	5.2	7.30 "
28,	12 "	3.6	6.	7.30 "
29,	7.30 "	0.2	3.6	12 "
30,	7.30 "	0.9	3.	8 "
31,	7.30 "	0.6	1.8	1 P. M.
June 1,	1 "	0.8	2.	9 A. M.
2,	7 "	— 2.7	1.7	8 "
3,	6.30 "	— 1.	3.2	8 "
4,	7 "	1.2	2.	8 "
5,	12 A. M.	2.5	4.7	8 "

NOTE.—A comparison of the recorded pressures of the several gauges as given in the foregoing tables, with the temperature, cloudiness, wind, barometric pressure and humidity, will enable a person to determine the relations existing between the spring flow of sap and the weather.

It will be noticed that the maple is apparently affected the most by the

GRAPE-VINE.

DATE.	Time of Minimum.	Minimum.	Maximum.	Time of Maximum.
1873.				
May 10, ...	7 A. M.	0.7	3.2	12 P. M.
11, ...	9.30 "	4.1	7.7	12 "
12, ...	12 "	7.7	11.5	12 "
13, ...	12 "	11.5	14.4	6.30 "
14, ...	12.30 P. M.	10.8	13.2	3.30 "
15, ...	7.30 A. M.	10.	16.8	9.30 "
16, ...	8 "	15.1	18.5	3 30 "
17, ...	8 "	16.3	20.1	6.30 "
18, ...	12.30 P. M.	17.8	21.	6.30 "
19, ...	12.30 "	17.8	21.7	12 "
20, ...	2.30 "	21.2	25.	12 "
21, ...	12 "	21.6	25.7	12.30 A. M.
22, ...	10.30 "	20.4	21.5	12 "
23, ...	12 A. M.	20.6	30.	12 P. M.
24, ...	12 "	30.	43.7	9.30 "
25, ...	1.30 P. M.	35.3	43.5	12 A. M.
26, ...	9.30 "	27.7	39.8	7.30 "
27, ...	12 "	25.7	30.1	7.30 "
28, ...	12 "	24.8	27.1	1.30 P. M.
29, ...	12 "	19.8	24.8	12 A. M.
30, ...	6.30 "	17.	19.6	12 30 "
31, ...	6.30 "	15.1	17.2	1 P. M.
June 1, ...	12 "	14.5	16.1	1 "
2, ...	12 "	10.5	14.5	12 A. M.
3, ...	8 A. M.	10.1	11.6	6 P. M.
4, ...	6 "	10.8	11.2	2 "
5, ...	12 P. M.	10.4	11.6	7.30 A. M.
6, ...	10 "	7.8	10.5	12 "
7, ...	8 "	7.	9.	8 "
8, ...	9.30 "	5.5	7.2	8 "
9, ...	12 "	5.	5.9	8 "
10, ...	12 "	4.3	5.	12 "
11, ...	10 "	2.8	4.3	12 "
12, ...	7.30 "	2.3	3.8	8.30 "
13, ...	12 A. M.	2.6	3.1	9.30 "
14, ...	1 P. M.	2.4	2 8	12 "
15, ...	1 "	1.6	2.4	12 "
16, ...	8 "	1.	1.6	12 "
July 16, ...	-	— 4.	— 6.	-

changes in the meteorological conditions in general, as well as by the alternations of day and night. The fluctuations in the birch are very decided early in May, when the leaves are expanding, while those in the grape-vine are very slight at any time, except as the mercury steadily rises to its maximum for the season and then as steadily declines.

Many more observations upon the different species are desirable before attempting to speculate concerning these remarkable phenomena, but these few data will serve as a beginning for more complete investigations.

APRIL, 1873.

Day of Month.	Thermometer in the open air. 7 A. M.	2 P. M.	9 P. M.	Mean.	Rain and snow. Time of begin'g of rain or snow.	Time of ending of rain or snow.	Am't of rain and melted snow in gauge, inches.	Depth of snow, inches.	Clouds. 7 A. M. Amount of cloudiness.	Kind of clouds.	2 P. M. Amount of cloudiness.	Kind of clouds.	9 P. M. Amount of cloudiness.	Kind of clouds.
1	36.0	48.9	37.0	40.3	Night.	–	–	–	–	Str. .	–	–	3	Str. .
2	35.8	39.8	36.5	37.4	–	8 P. M.	0.500	–	10	Nim. .	10	Nim. .	8	Str. .
3	40.8	47.0	39.0	42.3	–	–	–	–	8	Str. .	5	Str. .	7	Str. .
4	39.0	48.8	35.8	41.2	–	–	–	–	2	Str. .	1	Str. .	–	Str. .
5	34.4	42.2	38.0	38.2	*	–	–	–	8	Str. .	8	Str. .	10	Str. .
6	39.0	41.8	36.7	39.2	11½ A.M.	–	–	–	9	Str. .	10	Nim. .	10	Nim. .
7	35.6	46.3	41.0	40.9	–	10 A. M.	0.180	–	10	Fog, .	10	Str. .	10	Fog, .
8	40.1	52.8	43.8	45.6	–	–	–	–	10	Fog, .	5	Str. .	10	Str. .
9	43.8	45.0	37.2	42.0	†	–	0.120	–	10	Str. .	10	Str. .	10	Nim. .
10	38.5	52.0	35.5	42.0	–	–	–	–	3	Str. .	1	Str. .	1	Str. .
11	33.5	64.0	42.1	46.5	–	–	–	–	–	Str. .	2	Str. .	5	Str. .
12	40.8	38.9	37.0	38.9	Noon.	–	–	–	10	Str. .	10	Nim. .	10	Nim. .
13	35.0	45.1	39.9	40.0	‡	–	0.393	–	10	Nim. .	10	Nim. .	9	Nim, .
14	39.0	46.3	38.8	41.4	–	–	–	–	1	Str. .	9	Str. .	5	Str. .
15	40.5	49.0	41.5	43.7	–	–	–	–	8	Str. .	8	Str. .	2	Str. .
16	38.9	56.8	43.2	46.3	–	–	–	–	1	Str. .	–	–	3	Str. .
17	36.7	46.3	38.8	40.6	5 P. M.	Night.	0.285	–	10	Str. .	10	Str. .	10	Nim. .
18	37.8	45.5	40.0	41.1	–	–	–	–	10	Str. .	10	Str. .	10	Str. .
19	39.8	53.0	42.0	44.9	–	–	–	–	10	Str. .	8	Cu-str.	2	Str. .
20	41.7	52.2	38.8	44.2	–	–	–	–	5	Str. .	2	Cum. .	–	–
21	37.0	50.1	39.5	42.2	–	–	–	–	5	Str. .	8	Cu-str.	3	Str. .
22	35.0	48.0	37.5	40.2	–	–	–	–	3	Str. .	7	Cu. & Str. .	8	Str. .
23	39.5	52.5	41.5	44.5	–	–	–	–	3	Str. .	2	Str. .	–	–
24	37.2	55.0	40.2	44.1	–	–	–	–	–	–	7	Cu-str.	1	Str. .
25	34.8	49.8	36.5	40.4	–	–	–	–	3	Str. .	7	Cu-str.	–	Str. .
26	40.2	47.0	41.0	42.7	–	–	–	–	8	Str. .	8	Cu-str.	2	Str. .
27	45.8	52.5	44.0	47.4	–	–	–	–	4	Str. .	6	Cu-str.	–	–
28	41.5	60.0	51.5	51.0	–	–	–	–	–	–	2	Cu-str.	8	Str. .
29	44.8	66.2	50.1	53.7	†	–	0.260	–	3	Str. & Cir. .	4	Cum. .	10	Str. .
30	46.6	65.4	50.2	54.1	–	–	–	–	3	Str. .	8	Cu-str.	1	Str. .
	Mean, . . 43.23 Max., . . 66.2 Min., . . 33.5				Sum, ... 1.738				Mean, ... 5.7					

* Flakes and drops. † Shower in night. ‡ Squalls in night.

APRIL, 1873.—Continued.

WINDS.						BAROMETER. Barometer height reduced to freezing point.				FORCE OR PRESSURE OF VAPOR, In Inches.			RELATIVE HUMIDITY OR FRACTION OF SATURATION.			
7 A. M.		2 P. M.		9 P. M.												
Direction.	Force.	Direction.	Force.	Direction.	Force.	7 A. M.	2 P. M.	9 P. M.	Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Day of Month.
N.W.	1	S. E.	2	S. E.	1	29.741	29.768	29.812	29.774	.161	.170	.147	77	51	66	1
N.	2	N.W.	2	N.W.	1	29.643	29.486	29.512	29.547	.206	.228	.199	97	93	90	2
W.	2	W.	3	S. W.	2	29.600	29.583	29.686	29.623	.158	.156	.195	61	48	82	3
N.W.	2	N.W.	1	W.	1	29.831	29.841	29.925	29.866	.132	.157	.158	59	47	74	4
N. E.	1	N.W.	2	N.	2	29.960	29.941	29.877	29.926	.167	.170	.177	83	64	75	5
S. E.	1	S. W.	2	N.	1	29.882	29.835	29.792	29.836	.195	.195	.196	82	74	92	6
N.	1	N.	1	N.	1	29.755	29.697	29.695	29.716	.204	.245	.246	97	75	95	7
N.	1	S. E.	1	–	–	29.574	29.490	29.707	29.590	.245	.339	.252	95	85	87	8
N.	2	N. E.	3	N. E.	2	29.913	29.821	29.783	29.872	.229	.220	.195	79	73	86	9
N.W.	2	W.	4	W.	1	29.679	29.791	29.981	29.817	.219	.235	.183	93	61	82	10
S.	2	S. W.	2	E.	1	29.955	29.844	29.827	29.875	.171	.267	.200	89	45	74	11
N.W.	2	N. E.	3	N. E.	2	29.674	29.538	29.502	29.571	.158	.174	.197	61	74	88	12
N.	3	N.	3	N.	2	29.386	39.439	29.490	29.438	.199	.217	.200	97	72	81	13
N.W.	3	N.W.	3	N.W.	2	29.415	29.336	29.376	29.376	.176	.172	.176	72	54	75	14
N.W.	3	N.	3	N.W.	2	29.487	29.646	29.806	24.646	.179	.160	.179	70	46	68	15
N.W.	3	S. E.	2	S. E.	2	29.911	29.904	29.895	29.903	.188	.145	.153	78	31	54	16
S. E.	1	S. E.	3	N. E.	3	29.829	29.705	29.576	29.703	.176	.174	.145	81	54	61	17
N.	2	N. E.	2	W.	1	29.386	29.325	29.381	29.364	.188	.221	.215	81	72	87	18
E.	1	N.W.	3	N.W.	2	29.390	29.285	29.365	29.347	.211	.201	.199	85	49	74	19
N.W.	3	N.W.	3	N.W.	3	29.482	28.478	29.587	29.516	.202	.183	.110	76	47	46	20
N.W.	2	N.W.	2	N.W.	1	29.512	29.402	29.535	29.483	.147	.147	.167	66	40	68	21
S. E.	1	S. W.	3	S.	1	29.619	29.557	29.548	29.575	.173	.138	.179	84	41	78	22
W.	2	W.	3	N.W.	2	29.569	29.487	29.562	29.539	.153	.125	.144	62	32	54	23
W.	2	N.W.	2	N.W.	1	29.603	29.502	29.549	29.551	.171	.160	.154	76	38	61	24
S. E.	1	W.	3	E.	1	29.455	29.375	29.334	29.388	.163	.107	.116	81	31	53	25
W.	3	N.W.	4	N.W.	2	29.312	29.334	29.472	29.373	.141	.133	.164	56	41	63	26
N.W.	1	N.W.	3	N.W.	2	29.617	29.619	29.722	29.653	.167	.159	.151	54	41	52	27
S. E.	1	N.W.	3	S.	3	29.830	29.708	29.684	29.741	.184	.212	.193	70	42	51	28
N.W.	1	W.	2	S. E.	1	29.686	29.608	29.712	29.669	.231	.234	.281	78	37	77	29
S.	1	W.	2	N.W.	1	29.830	29.808	29.861	29.833	.301	.222	.229	94	35	63	30

Per cent. of Time and Force:	Barometer	Vapor	Humidity
N. W. & W. 57;	Mean, ... 29.637	Mean,. . .175	Mean, . . 68
S. W. & S. 9;	Max., ... 29.981	Max.,. . .339	Max., . . 97
S. E. & E. 11; N. E. & N. 23.	Min., ... 29.285	Min., . . .107	Min., . . 31

MAY, 1873.

Day of Month.	Thermometer in the open air. 7 A. M.	2 P. M.	9 P. M.	Mean.	Rain and Snow. Time of begin'g of rain or snow.	Time of ending of rain or snow.	Am't of rain and melted snow in gauge, inches.	Depth of snow, inches.	Clouds. 7 A. M. Amount of cloudiness.	Kind of clouds.	2 P. M. Amount of cloudiness.	Kind of clouds.	9 P. M. Amount of cloudiness.	Kind of clouds.
1	47.0	69.0	55.2	57.1	-	-	-	-	-	-	2	Cum. .	5	Haze, .
2	51.3	46.2	38.5	45.3	9 A. M.	-	-	-	10	Str. .	10	Nim. .	10	Nim. .
3	39.0	40.3	35.0	38.1	-	Night.	1.028	-	10	Nim. .	10	Nim. .	10	Nim. .
4	40.5	58.0	48.0	48.8	-	-	-	-	-	-	-	-	-	-
5	47.7	67.1	51.0	55.3	-	-	-	-	7	Str. .	3	Cu-str.	-	-
6	44.3	63.5	48.0	51.9	-	-	-	-	-	-	-	-	-	-
7	42.5	66.3	51.2	53.3	-	-	-	-	2	Cir. .	5	Cir. .	2	Cir. .
8	44.1	63.8	48.7	52.2	Night.	-	-	-	5	Cir. .	4	Cir. .	8	Str. .
9	44.9	47.0	44.9	45.6	-	Night.	0.898	-	10	Nim. .	10	Nim. .	10	Nim. .
10	47.4	57.5	55.0	53.3	-	-	-	-	10	Str. .	9	Str. .	10	Str. .
11	53.0	54.2	51.2	52.8	4 A.M.* 2 P.M.	-	1.104	-	10	Nim. .	10	Nim. .	9	Str. .
12	52.4	62.0	48.0	54.1	-	-	-	-	8	Str. .	7	Cu-str.	-	-
13	51.5	58.5	47.3	52.4	2 P. M.*	-	0.100	-	7	Str. .	10	Nim. .	2	Str. .
14	44.4	55.8	49.7	50.0	-	-	-	-	2	Str. .	1	Cum. .	7	Str. .
15	46.9	61.3	51.5	53.2	-	-	-	-	-	Str. .	1	Cu-str.	8	Str. .
16	50.0	60.0	53.0	54.3	-	-	-	-	7	Str. .	8	Str. .	5	Str. .
17	53.7	59.5	51.0	54.7	-	-	-	-	2	Cu-str.	8	Cu-str.	8	Str. .
18	54.0	59.0	49.0	54.0	Squalls.	-	0.049	-	-	Str. .	3	Cum. .	-	-
19	47.1	65.5	50.2	54.3	-	-	-	-	5	Str. .	4	Cum. .	-	-
20	45.0	66.0	51.8	54.3	-	-	-	-	-	-	-	-	5	Str. .
21	49.0	62.4	47.0	52.8	6 P. M.	Night.	0.564	-	7	Str. .	9	Str. .	10	Nim. .
22	46.1	61.8	60.5	56.1	Mist.	P. M.		-	10	Str. .	9	Str. .	10	Nim. .
23	60.0	74.5	62.7	65.7	-	-	-	-	9	Str. .	8	Cu-str.	3	Str. .
24	63.5	79.0	65.7	69.4	Drops.	1 P. M.	-	-	9	Str. .	5	Cum. .	-	-
25	61.5	73.8	61.0	65.4	-	-	-	-	-	-	3	Cum. .	-	Str. .
26	58.3	80.0	63.7	67.3	-	-	-	-	1	Str. .	3	Cir. & Cum.	1	Str. .
27	60.0	76.2	63.0	66.4	-	-	-	-	1	Cum. .	5	Cu-str.	3	Str. .
28	63.0	82.0	70.0	71.7	† Rain.	6 P. M.	0.167	-	10	Fog, .	8	Cum. .	8	Nim. .
29	65.8	77.0	64.0	68.9	-	-	-	-	5	Cir. .	3	Cum. .	-	-
30	60.0	62.0	52.2	58.1	-	-	-	-	9	Str. .	6	Str., .	-	-
31	47.0	66.0	52.8	55.3	-	-	-	-	-	-	-	-	-	-
	Mean, . . 54.58 Max., . . 82.0 Min., . . 39.0				Sum, ... 3.910				Mean, ... 0.0					

* Thunder shower.

† Thunder showers around.

MAY, 1873.—CONTINUED.

WINDS.						BAROMETER.				FORCE OR PRESSURE OF VAPOR, IN INCHES.			RELATIVE HUMIDITY OR FRACTION OF SATURATION.			Day of Month.
7 A. M.		2 P. M.		9 P. M.		BAROMETER HEIGHT REDUCED TO FREEZING POINT.										
Direction.	Force.	Direction.	Force.	Direction.	Force.	7 A. M.	2 P. M.	P. M.	Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	
W.	1	W.	2	S. E.	2	29.934	29.816	29.764	29.838	.220	.197	.252	68	28	58	1
S. E.	2	E.	3	N.	2	29.712	29.581	29.487	29.593	.287	.254	.212	76	78	91	2
N. E.	3	N. E.	3	N.	2	29.378	29.348	29.487	29.404	.205	.194	.195	84	76	95	3
N.W.	1	N.W.	3	N.W.	1	29.625	29.661	29.716	29.661	.204	.165	.212	81	34	63	4
S. E.	1	N.W.	4	W.	1	29.720	29.710	29.884	29.771	.246	.166	.199	74	26	53	5
N.W.	1	W.	1	N.W.	1	30.059	30.024	30.049	30.044	.142	.274	.189	66	47	56	6
S. E.	1	N.W.	2	S. E.	3	30.140	30.082	30.076	30.099	.208	.156	.173	76	25	46	7
S. W.	1	S. E.	3	S. E.	3	30.155	30.049	30.037	30.080	.203	.166	.154	70	29	46	8
N. E.	2	N. E.	3	N. E.	3	29.949	29.906	29.869	29.908	.250	.273	.270	84	85	90	9
N.	2	S. E.	2	E.	1	29.801	29.776	29.781	29.786	.292	.372	.373	89	78	85	10
S. E.	2	S. E.	1	N.	1	29.689	29.566	29.477	29.577	.382	.394	.345	93	92	91	11
N.W.	2	W.	3	N.W.	1	29.433	29.431	29.515	29.460	.351	.259	.175	88	48	52	12
S. E.	2	N.W.	4	N.W.	3	29.395	29.198	29.407	29.333	.238	.423	.184	62	88	55	13
N.W.	3	N.W.	4	N.W.	3	29.511	29.420	29.427	29.453	.167	.172	.125	57	39	34	14
N.W.	3	N.W.	2	N.W.	2	29.473	29.473	29.552	29.499	.171	.228	.214	53	42	56	15
S. E.	1	W.	2	N.W.	1	29.583	29.554	29.587	29.575	.280	.224	.270	76	43	68	16
W.	1	W.	3	S. W.	2	29.602	29.587	29.658	29.616	.260	.190	.240	63	38	64	17
N.W.	1	N.W.	3	N.W.	1	29.675	29.647	29.759	29.694	.260	.207	.152	63	42	44	18
S. E.	2	N.	2	S. E.	3	29.730	29.687	29.822	29.749	.265	.189	.205	81	31	57	19
W.	1	S. W.	2	S. E.	3	29.980	29.946	30.007	29.978	.228	.207	.186	76	33	48	20
N.W.	2	S. W.	3	S. W.	1	30.064	30.013	30.007	30.028	.267	.266	.278	77	49	86	21
N.W.	1	S. W.	2	S.	1	29.934	29.866	29.837	29.879	.303	.248	.436	96	45	80	22
S. E.	2	S. W.	3	S.	3	29.788	29.688	29.606	29.694	.471	.585	.497	91	70	87	23
S. B.	3	N.W.	4	N.W.	4	29.474	29.334	29.471	29.426	.542	.454	.309	92	46	49	24
S. E.	1	N.W.	3	N.W.	1	29.562	29.616	29.717	29.632	.421	.367	.332	77	46	63	25
N.W.	1	S. E.	3	S. E.	3	29.865	29.788	29.796	29.816	.419	.508	.306	86	51	52	26
S. E.	3	S. E.	3	S. E.	4	29.778	29.680	29.626	29.695	.355	.520	.364	68	58	75	27
S.	3	S. E.	3	W.	1	29.583	29.463	29.552	29.553	.552	.734	.544	95	69	73	28
E.	1	S. W.	2	S. E.	2	29.682	29.731	29.654	29.668	.548	.473	.406	87	73	68	29
N.W.	3	N. E.	4	N.W.	2	29.713	29.780	29.922	29.805	.376	.179	.180	72	32	46	30
N.W.	2	S.	1	E.	1	30.311	30.062	30.045	30.073	.213	.320	.249	66	50	62	31
Per cent. of Time and Force: N. W. & W. 42; S. W. & S. 12; S. E. & E. 32; N. E. & N. 14.						Mean, ... 29.722 Max., ... 30.311 Min., ... 29.198				Mean,. . .287 Max.,. . .734 Min., . . .125			Mean, . . 64 Max., . . 96 Min., . . 25			

Explanation of Plates.

Plate I. represents the variations of pressure as indicated by the mercurial gauges on the 21st of April, 1873, observations having been taken every hour from 1 A. M. to 12 P.M. Every vertical line marks an hour, and every horizontal line an inch on the column of mercury. Zero represents the point where there is neither pressure outward nor suction inward.

The line A shows the record of the sugar-maple, which at midnight exhibited a suction equal to –6 feet, and at 7 A. M. had increased this to –22.9 feet. As soon as the sun warmed the tree, the mercury began to rise, and at 9.15 A. M. had reached 16.3 feet. Then it declined very gradually, till at 12 P. M. it was at –3 feet. The temperature at 7 A. M. was 37° F., at 2 P. M. 50.1° F., and at 9 P. M., it was 39.5° F.

The line C marks the fluctuations of the mercury in the lower gauge of the black birch, which was at the level of the ground, and the line B shows the pressure in the upper gauge, which was placed 30.2 feet above the lower one. The remarkable fall indicated as occurring at 12.45 P. M. was caused by boring into the tree near the ground for the purpose of determining whether the tree was acting simply as a cylinder of water filled by a force from beneath, as seemed evident from the correspondence between the two gauges. The reduction and restoration of pressure from simply opening and closing the orifice were so rapid and extraordinary as to lead to the conclusion that the force operating to produce the pressure was simply the absorbent power of the roots, and this led to the application of a gauge directly to a root with the marvellous result already described.

Plate II., Fig. 1, is designed to illustrate the rotation of the contents of large cells, such as are observed in some aquatic plants.

Fig. 2 represents the tip of a growing hair on the stamen of a flower, showing the separate cells, with protoplasm and nucleus in each, and the beginning of division in the contents of the upper one for the development of a new cell.

Fig. 3 is a zoöspore or motile germ of a unicellular alga, furnished with two cilia, by the spontaneous movements of which it swims through the water.

Fig. 4 is the mature plant containing protoplasm, nuclei, and chlorophyl, and enveloped in a membrane of cellulose and a coating of mucilage.

Fig. 5 represents a section both vertical and horizontal of a branch of a sugar-maple, two years old, as it appears in December. The portion included in the lines marked A is of the first year's growth; those marked B indicate the wood of the second year; while those marked C inclose the three layers of the bark. D represents the pith of loose cellular tissue; E the pith rays or silver grain of hard cellular tissue connecting the pith with the green or middle layer of bark, which also consists wholly of cellular tissue; F marks the outer or corky layer of the bark, which is composed of dry, dead cells, which are formed of consecutive layers from the outer portion of the living green layer; G is the green layer of cellular tissue. H shows the liber or inner bark, made up

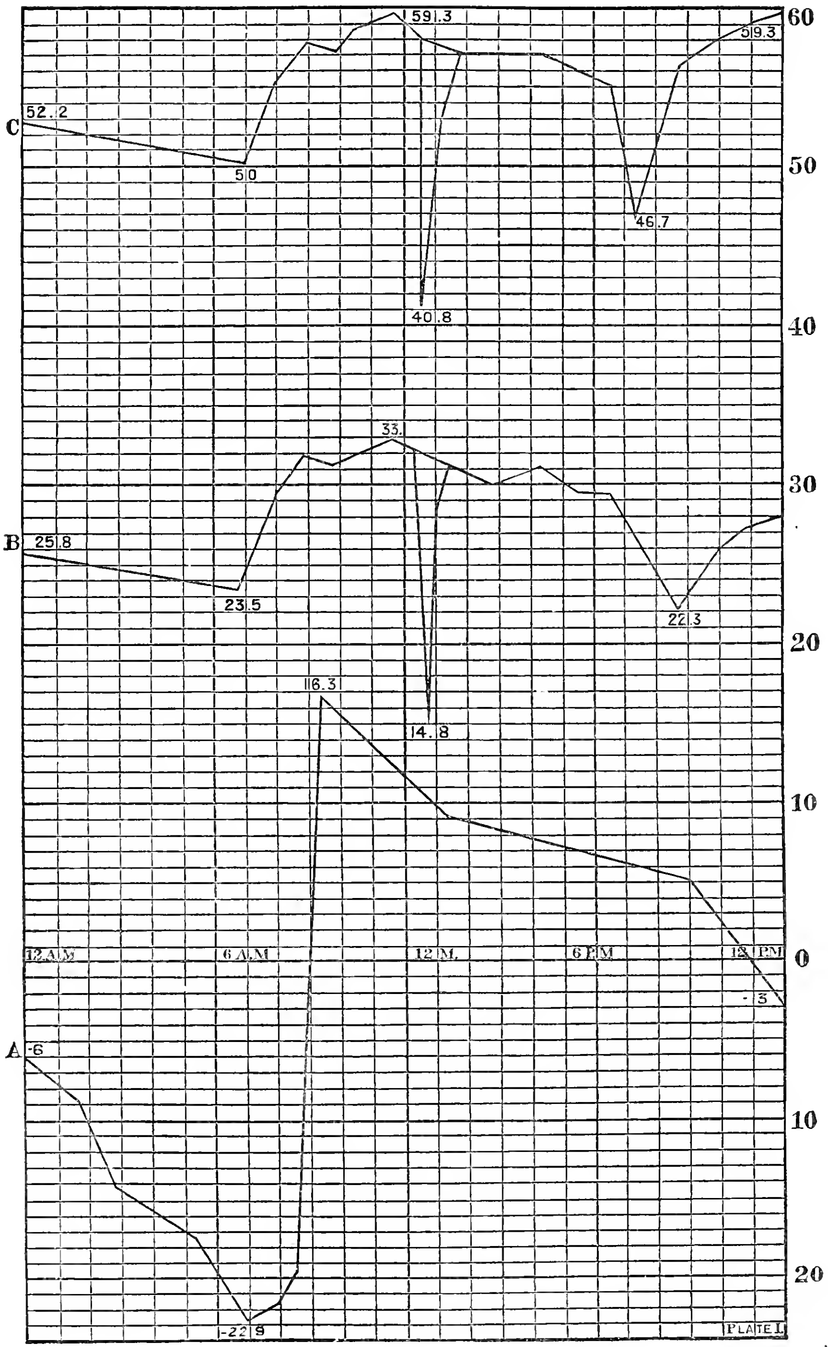
60
59.3
59.3
C
52.2
50
50
46.7
40.8
40
33.
30
B
25.8
23.5
22.3
20
16.3
14.8
10
12 A.M
6 A.M
12 M.
6 P.M
12 P.M
0
-3
A
-6
10
20
-22.9
PLATE I.

PLATE I.

of cellular tissue penetrated by long bast cells, arranged parallel with the axis of growth. I represents the place of the cambium or growing layer of organizable material which descends from the leaves between the liber and the sap-wood during the period of growth. K is woody fibre which gives strength to the stem, and through which the crude sap rises. L indicates the vessels or ducts, with various markings, such as dots, rings, and spirals, which are formed most abundantly in the spring, and usually contain no fluid. They convey gases and aqueous vapors, and it may be that a large proportion of all the water ascending from the roots to the leaves passes through them as vapor. M is the layer of spiral vessels or ducts which always inclose the pith, and in the young shoot extend into the leaves and unite them to the pith during its life, which ceases with the first season.

Plate III., Figs. 1, 2, 3 and 4, represent the lilacs in the experiment of Prof. Rainey. Fig. 1 shows tho condition of them all when a ligature of copper-wire was placed upon them in the spring of the first year. Fig. 2 gives the appearance of a vertical section at the end of the first season, a new layer of wood and of bark having been formed over the entire plant, but in consequence of the compression of the wire they are seen to be much thinner below than above it. Fig. 3 illustrates the appearance of a stem at the end of the second season of growth, the usual layers having formed down to the ligature, but none below. Fig. 4 represents the section of a specimen in June of the third year, the buds which had remained plump all winter having now withered, and the part below the wire being brown and dead.

Fig. 5 exhibits the effect of removing rings of bark from a branch. The rings of bark left on the wood at A do not increase at all, though remaining fresh through one season of growth, while the rings marked B are seen to have grown, particularly at the lower margin. The reason is to be found in the fact that the former have no leaves to elaborate sap, while the latter are furnished with these important organs of assimilation.

Fig. 6 is a maple rootlet covered with absorbent hairs, except near the tip, which is pushed forward into the soil by the development of new cells at a point a few lines from the very extremity. This penetrating end of the rootlet is seen to be furnished with loose epidermal cells, marked B, which are thrown off as the growth proceeds. At A is seen a mass of earth filled with root-hairs.

Fig. 7 shows the mode of constructing the mercurial gauge and attaching it to a tree. At A is a stop-cock screwed firmly into the sap-wood to which the glass tubing is connected by couplings of iron. The gauge is securely fastened to a scale, which may be enclosed in a box. Tlie tube on the right may be lengthened and mercury added, should the pressure necessitate it. When the mercury stands at the same level in both sides of the inverted siphon, as at B, it is said to be at zero. In taking observations, the difference in the number of inches of mercury in the two sides is to be noted, and this will indicate the pressure or suction according as it is observed in the right or left side of the bent tube. In recording, the minus sign is prefixed to indicate suction into the tree.

The drawings for these illustrations were made by Prof. S. T. Maynard.

PLATE II.

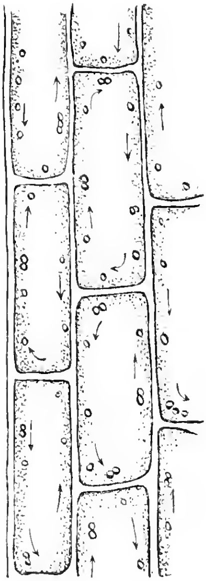

Fig. 1.

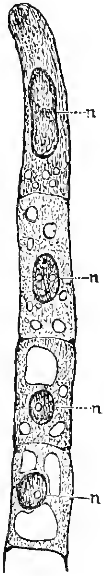

Fig. 2.

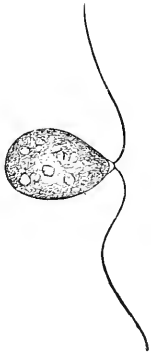

Fig. 3.

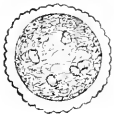

Fig. 4.

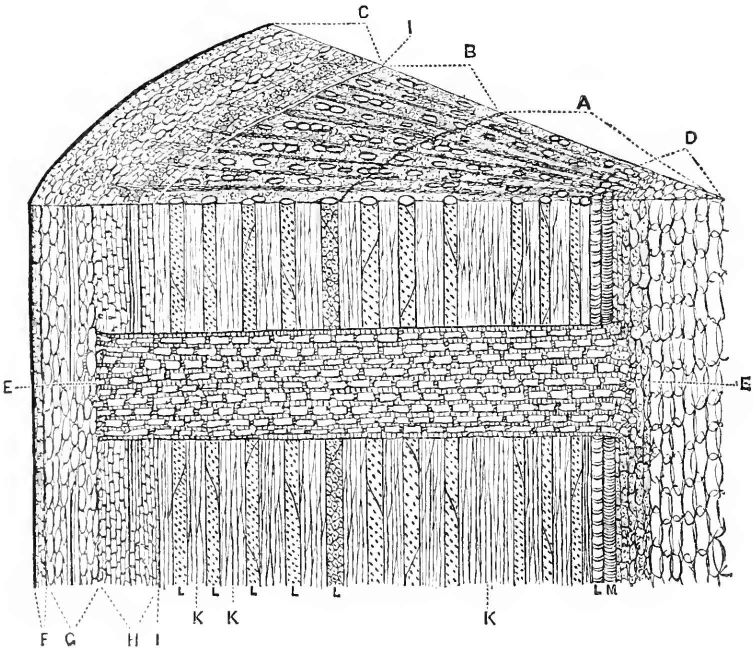

Fig. 5.

PLATE III.

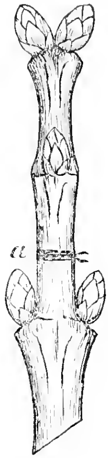

FIG. I.

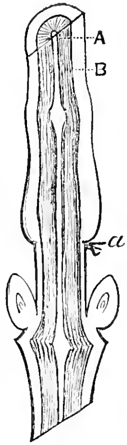

FIG. II.

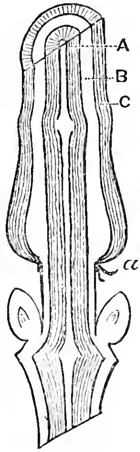

FIG. III.

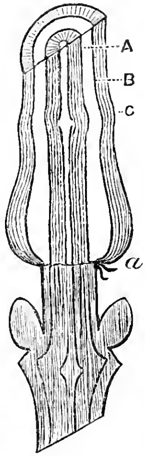

FIG. IV.

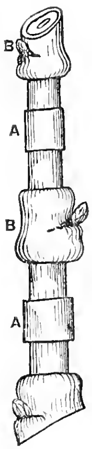

FIG. V.

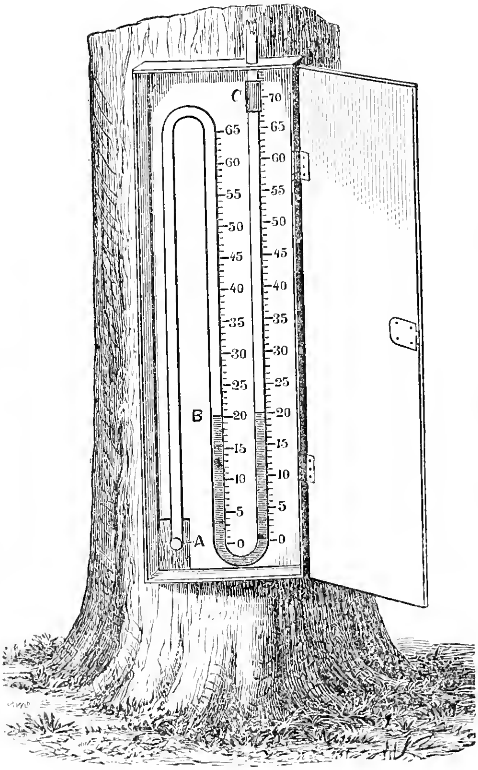

FIG. VII.

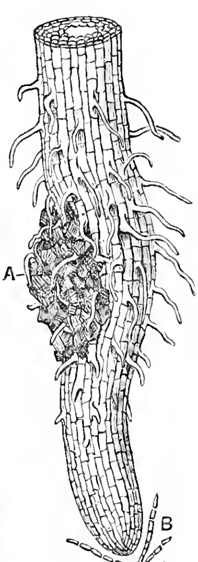

FIG. VI.

Prof. Agassiz. *Mr. Chairman,*—May I request you to grant me half a minute before you call upon the gentleman who is to speak next.

I need not praise what has been said by Pres. Clark, now, for the man who can make such investigations, and report them in such a manner, has the reward of his work in himself, and no eulogy from others can add to his gratification; but I would not allow this opportunity to pass without saying a word with reference to the Agricultural College at Amherst. From this day forward that institution has its place among scientific institutions, if it had not before; for only those institutions have a place in the scientific world which do something, and this is something extraordinary; it is a revelation to physiologists. Let me say to those who have not thought that the Agricultural College was doing anything worth its expense, that the production of this one paper has amply paid for every dollar which the State has thus far bestowed upon the institution.

MANAGEMENT OF GRASS-LANDS.

The management of grass-lands was the next subject for discussion, and was opened by Hon. Harris Lewis, of Herkimer County, N. Y.

Mr. Lewis. After listening to Col. Clark, I feel that I ought to sit down and reflect upon what he has said, for I do not believe that we shall have brought before us during this session any subject of equal interest. He has presented to us one of the greatest discoveries of the age, and I fully agree with my friend, Prof. Agassiz, that that discovery alone has paid the people of Massachusetts, or will pay them, for every dollar, for every penny expended on that college; I only wish that I could present some discovery in regard to the management of grass-lands that would be equal to it, but I cannot. Yet, I have discovered one thing, and that, too, accidentally, perhaps. My farm lies on the north bank of the Mohawk River, and, ordinarily, the lower lands, twenty-five acres, are flooded. There is a little muddy water sent over it every spring, and usually every fall, and I

find that is all grass-land requires—a little muddy water. The sediment left is thinner than a sheet of paper, yet the fertilizing matter is sufficient for a year's growth of grass. I have taken the hint from this, and dissolved clay and swamp-mud in water to test its fertilizing power on grass, and I find that by stirring up a pailful of spring-water and a little clay or swamp-mud together, and turning it over a given area of grass it produces as much growth, provided the roots are healthy and vigorous, as an equal amount of manure,—the liquids and solids mixed together and spread over the same surface.

I had another hint. On the upper end of my farm there comes in a little rill from the woodland, and this, when the snow goes off in the spring, brings down a little water, and the water is a little muddy. Well, wherever that spreads out over the pasture on its downward course toward the Mohawk, there is no trouble in having all the grass that will grow. Hence I have taken the hint, and believe that the best top-dressing for meadows or pastures, if the roots of the grass are healthy and vigorous, is muddy water.

Now, how many of you can irrigate a portion or the whole of your pastures or meadows? Let me suggest to you that, with a plough or scraper, you make an artificial pond in some place, pretty well toward the upper side of your pasture or mowing-field, where you can turn a stream in, and when the snow goes off in the spring, plough up the mud of that pond with a yoke of oxen, harrow it, or cultivate it, or do anything to it that will stir up the mud, and when you get it thoroughly stirred up, open the gate, or break away the dam, and let it spread out over your land. I wish you would all try this, and see what the effect will be. If you find that it pays, you can make these artificial ponds every year, and let your muddy water out in that way over the land below it. If it does not pay, I do not ask you to try the experiment a second time; but I think it will pay.

I do not advise any top-dressing, with any material whatever, unless the roots are in a healthy condition. If they are unhealthy, the better way is to plough them up; but most of our grass-lands that have been in use a great while are lacking in phosphates, and you will find that a light sprinkling of

bone-meal over such lands will produce a wonderful effect. I have also found that much of your grass-land lacks potash, and that the application of about four bushels of wood ashes per acre will effect a marvellous improvement. I have found, too, that in some parts of my own land, where I have top-dressed with manure for several years, a small coating of lime, say twenty bushels to the acre, will produce very beneficial results.

But I would suggest to every farmer here that he divide off a certain piece of his mowing or pasture land into alternate strips, leaving one between each two that he lets alone, and try the different fertilizers. You can try one kind on one strip, another on another, and carefully note the result, count the cost, estimate the additional growth, and each man will soon decide for himself what is the best course for him to pursue. I find that a little sprinkling of pure clay without the water, on a light, loamy or sandy soil is sufficient for a long time; that a little swamp-mud, after it has been exposed to the atmosphere a year, spread over a light soil, is equal to the best top-dressing for grass-lands in the world; and I find, too, that sand, pure sand, spread over a stiff clay soil, or on swamp-muck, is an excellent fertilizer for years. But I would say to you, that if your grass is unhealthy, if the roots are not vigorous, I know of no way so good as to summer-fallow, if you can do it. If your grass-land is so you can plough it, commence and make a thorough summer-fallow of it. I prefer this to sowing it with grain, cropping it, and then re-seeding it. If you are afraid of any loss of plant-food, sow with plaster before you commence, and you can add another coat during the summer. Plough about three times, just as thoroughly as you would for a wheat-field, and then, about the last half of August, seed it down. This summer-fallowing rids your land of every kind of foul stuff that may have grown in it. It gives you a beautiful clean field, where the grass-seed will catch and grow. It has the benefit of the whole of the sunshine, and it has the whole of the soil to draw upon. It has this plant-food that it obtains from the old turf, the very fertilizer that it wants, and I will assure you that you will do better by adopting this method than you will to plough it up and crop it, and then try to seed it again.

In seeding lands for pastures, I would sow almost every kind of grass that grows, so as to get a succession of grasses through the season; and I would seed mowing-lands with several kinds of those grasses that ripen about the same time. Somebody has remarked that the grasses are social in their habits of growth, and I believe this to be true. There is no one kind of grass that I know of that will occupy the whole of the soil; but if you sow two kinds there will be less of it unoccupied than there will be with only one kind; and if you sow three kinds, you have still less of the soil unoccupied. This is the same view I presented to the meeting at Barre, last winter, I believe,—that we ought to sow more kinds of grass-seed; and I will assure any farmer who will try it, that this summer-fallowing is not a loss of a season. It may seem so, and I know that a good many farmers think that a summer-fallow is a summer lost, that a piece of land fallowed is lost; but I regard it otherwise, and I think any one of you who tries the experiment will find that the summer is not lost, but it will give you a growth of grass that will be astonishing for several years to come.

Mr. Flint told me that in opening this discussion, I might suggest as little or as much as I pleased. Now, I have said as much as I desired to say. The subject is open for you, and I hope you will discuss it "with the spirit and with the understanding also."

Mr. Kilburn, of Lunenburg. I like the suggestion made by the last speaker, that, in sowing grass-seed, we should sow those kinds that ripen about the same time. We have had a good deal of trouble with our different grass-fields, by having the grasses ripen at different times through the spring and summer. Some kinds will get ripe and shed their seeds before the main growth of the grass is fit to cut. Take, for example, the sweet-scented vernal grass, spear-grass, or what is sometimes called Kentucky blue-grass, and two or three other kinds; the *Danthonia spicata*, for instance, which is sometimes called white-top, and sometimes has other names. That, if cut early, makes very good hay; but, if it is cut late, it is not better than the straw of grain that has been threshed, and it frequently gets ripe before the later grasses are fit to cut; red-top being one of the latest, timo-

thy or herdsgrass being another, not fit to cut until a certain time; and these other grasses getting ripe first and shedding their seeds, as a good many of them do, before the later grasses are ready for the mower. The sweet-scented vernal grass very frequently blossoms in May, and several of the other grasses, for instance, spear-grass, or Kentucky blue-grass, get ripe and are ready to be cut before the other grasses, which predominate in the field, are fit to be cut. Therefore, in seeding down our fields to grass, we ought to use the seeds of those grasses which come to perfection about the same time.

Mr. Lewis. You mean for mowing-lands, not for pastures?

Mr. Kilburn. I mean for mowing-lands; for pastures, I don't care how many kinds I have; but, in mowing, we want to take the grasses when they need to be cut. There is a particular time when our grass will be going back, or down-hill, if we do not cut it, and if we can strike it at the right time, we save it. But when there is a range of four or five weeks in the ripening of the different species of grass, while one kind is gaining another kind is losing. That subject, I think, has been well presented by the gentleman who has spoken to us on that question, and I think it is one of great importance. Most of these grasses that I speak of will come in themselves, without sowing them. The sweet-scented vernal grass finds its way in. We have not found it on our land a profitable crop; it ripens too early for the other grasses. It is just so with the spear-grass, or Kentucky blue-grass; it is ripe at a different time from the other grasses, and there is an insect that works upon that grass, unfortunately, just above the upper joint, and eats the culm off close to the top. I suppose all farmers have noticed that fact.

Dr. Spaulding, of Groton. The idea has just been advanced of summer-fallowing. I think that is a system which is but very little practised in Massachusetts, and I would like to ask Mr. Lewis somewhat of the mode. We all know that in turning up sward-land, it takes some little time to get it into condition, unless we cross-plough it, or plough it several times in the same season. I would ask him if he expects us to plough in the spring or the autumn previous, and the mode of procedure. In Massachusetts, and in this vicinity, farm-

ers have adopted the practice of turning their sward-land over immediately after haying, after the crop of grass has been taken off, and then re-seeding, not disturbing the sod at all. Mr. Lewis seems to claim a great advantage from allowing the land to rest one season. I think there may be something in it, but I do not fully understand the mode. I think it will be difficult to cross-plough soon enough to re-seed and get that ground mellow.

Mr. LEWIS. I would say, that sod well ploughed about the tenth of June, and harrowed soon after, will be in condition to cross-plough by the middle of July. In our section, the toughest soil will be so that you can cross-plough, and I guess it would be the case here, but I don't know. It depends somewhat upon the season. The sod would mellow down sooner some seasons than others, but, as a rule, sod ploughed up the first time about the tenth of June, can be ploughed by the middle of July the second time, and then along in the autumn, you can plough it again.

Mr. FAY, of Southborough. In the place I come from we cannot farm it without manure; it would be like a manufacturer undertaking to carry on business without capital. We want to put on fifty loads of manure to the acre every other year. You can cut three tons of hay to the acre, if you manure properly, and no farming can be carried on profitably without the application of manure. To remain in grass, the land must be low and moist; on high land we plough it, but it would be very difficult to plough our land in June, with our tough swards, and have it in suitable condition to seed down in the month of August; but in Herkimer County, which I am very well acquainted with, it would be different, because the character of the soil is very different. What would answer for Mr. Lewis's land would not answer for our land in Southborough.

Now, in regard to pastures. We commenced using plaster on our pasture-lands some five years ago, and we have used it until it does no good at all. You may put from two hundred to five hundred pounds on an acre, and you cannot see any good result from it. Ashes do not do much the first year. You will get discouraged if you try them, and perhaps the second year the benefit will not be of much conse-

quence. If the season is very moist, sometimes you will see a little benefit the first year, but you will see the effect for ten years. I have used twenty-five bushels of unleached ashes to the acre. I would not give for leached ashes ten cents a bushel, when I would give for unleached ashes forty cents a bushel; there is all that difference between them. If you put twenty-five bushels on an acre, it will last you ten years, and produce an abundance of most excellent feed. There is nothing so valuable for pasture-lands, but the great difficulty is to obtain ashes. It is almost impossible, because the soapmen come round and pick up the ashes.

In regard to the application of water and mud or clay, of which Mr. Lewis spoke, let me say that, I do not know but it will answer for Herkimer County, but I really think, in my section, it would not be of much value. But I know that if you spread the sub-soil which has lain three feet deep on top of your light lands, white-clover will come in in three years; and the application of manure will do more good, and the more manure you put on the more good it will do.

Mr. Lewis. I was afraid my friend there misunderstood me. I don't want to be understood as saying that manure does not agree with my land; it agrees with it first-rate. I find that manure agrees with grass-land, but I can use other things there, and have my manure to use on my crops. That is all there is about it. You can use clay, you can use sand, you can use thorough underdraining, which is equal to any kind of manure, where the land needs it; you can use swamp mud, and you will have your manure to use besides. But what I wanted to remark principally was, that manure agrees with my land, as it does with his.

Dr. Sturtevant, of Framingham. I would like to ask Mr. Fay whether he feeds his mowing-lands.

Mr. Fay. I never want to, if I can get along without it. Sometimes, in dry seasons, I am obliged to turn my cattle in to feed on the second crop. I do it against my own judgment, but I do it once in a while.

Dr. Sturtevant. I think that is a very important point. My experience leads me to question the advantage of feeding mowing-lands close in autumn. On our Massachusetts soils, underlaid with gravel, the soaking of the spring rains does

not preserve the roots long from the effects of the dry weather following. The grass-roots lying near the surface of the upper soil, are the first to feel the drought, and allowing the grass to be closely bitten off at the approach of winter is to expose the roots, upon the coming of spring, to drying winds and thirsty sunshine. To shut out these influences, and to maintain in the soil a reservoir for the growing grass from one rain to another, is, when the soil is well pulverized and rich, to have plenty of grass. This may be done by simply keeping our cattle off the mowing-fields after haying, and allowing the grass to attain a height of several inches before winter. The frost kills the grass, the snow mats it close to the roots, and the spring sun finds every root under the protection of a mulching that retains the moisture in the soil for a considerable period of time after rains.

Mr. Allis, of Conway. The subject of cultivating grasses is a subject which I think should and does interest us all, perhaps, as much or more than any subject which has been or is to be brought before this meeting at the present time. Our Secretary has this morning given us some idea of the improvement which has been made in the last half century in the cultivation of our grasses. Our friend from Herkimer has given us some idea in regard to the cultivation of grasses which, as has already been said, may answer very well for his location, and may also, to some extent, answer for us; but in the Connecticut Valley, which is perhaps the best grass section in our State, taken altogether, we find, gentlemen, that, in order to create an abundance of grass, we must use our common fertilizers very generously. It has been the practice up and down that river, for a few years past, to manure a certain portion of the land every year. Perhaps you are well aware that in the cultivation of tobacco, some have followed it for a number of years in succession, and then seeded the land down, in some cases with wheat, and harvested great quantities, as high as fifty bushels of winter-wheat to the acre, and have mowed the land so long as the grass grew luxuriantly. I would say that, after thus seeding, I have mowed heavy crops of grass for six years in succession, two crops each year. But, sir, they are experimenting somewhat still. There are many who now manure highly for

two years and then seed down, without sowing any grain with their grass. In this way they think they will be enabled to obtain a greater crop of grass for a longer time, giving them a chance to bring under cultivation more of their ground. I have for the last year or two been attempting to go a little further in this line, by turning over in the fall of the year the sod of as many acres as I can manure thoroughly, and I endeavor to take all the pains I can to make the manure-heap as large as possible. I agree with our friend from Herkimer, that sand is a fertilizer, and I have practised for a year or two drawing from twenty-five to fifty loads of sand almost one mile, to litter my stock; and I have found, when I have used that during the winter, and carted out my manure in the spring and spread it on my fields, that it seems to be all pulverized; there are no lumps in it. It spreads out fine and works into the ground admirably, and as my lands are rather of a loamy character, sand mixes with them very admirably indeed, and I see the profit, by putting on about fifty ox-loads to the acre, and then raising a crop. As soon as I take the crop off, or very soon after, I put on a harrow, manufactured by the same company, I think, which manufactures the Sprague Mower, and I plough the ground and cultivate it with this harrow. By going over it twice, my land will be mellowed up very fine and light, and fitted to seed right down. Last year I sowed in the spring three acres, and seeded it down with oats. The oat-crop being very late this year generally, I mowed about the first of October what I considered good three tons of grass, with what little stubble there was in it. My cattle at the present time seem to eat it as eagerly as any hay or any rowen that I cut, and by seeding down so early, the grass grew so luxuriantly that it gave me a great crop. I took off my crop of the Connecticut River staple on five acres, used this harrow, and seeded it down. Now, I propose next year to do the same thing. I have broken up nearly four acres of turf, and I am now drawing manure four miles for the next season. When I break up a piece of land, I hold to manuring it thoroughly. I think I can do it in one year, and by so doing and following it up in rotation, I shall bring my twenty-five acres into rotation at different times, before the grasses are worn down or

run out. I know that by following this method I shall get a first-rate quality of grass, and I think I shall be able to get large crops, too, which I think will be the manner of proceeding with us that will increase our grass-crops up and down the river exceedingly.

Mr. SLADE, of Somerset. I tried a little experiment connected with this matter which may perhaps be worth while to state to the gentlemen present, considering the discussion has taken the course that it has. I know the subject of raising grasses is a very important one, and I think that the old custom of sowing grass-seed with grain is one that should be discontinued; there is no fact better established on my own land than that. Consequently, last spring I experimented in that respect. I took a piece of ground that had been planted some dozen or fifteen years (and by the way, it was unfavorably situated, from the fact that it was penetrated on its borders by the roots of elm-trees which ran under it for a hundred feet or more). I ploughed it the first day of April, and pulverized it perfectly. I worked it over and got it smooth, and sowed herdsgrass, red-top and clover. The grass came up very readily, much more so than I expected, and looked finely up to about the 20th day of May, when the drought commenced, and having the roots of these elm-trees under it, of course it suffered severely from drought; but notwithstanding that fact, when the rains came on, the grass improved, and on the 9th day of July, I cut a ton to the acre—estimated. On the 19th of August, it was cut a second time, and produced at the rate of two tons to the acre. Those two crops were simply clover. On the 22d day of September, it was estimated by good judges that there were two tons to the acre standing on the ground. All the manure or fertilizer that was applied to it was some of the animal-dust, which I purchased of Mr. North, of which we had an analysis at our last meeting. I used that at the rate of $10 worth to the acre.

On the 15th day of April, I took another piece, which was situated on a side-hill where the soil was gravelly. I did not expect very favorable results from that; and in fact I did not get very favorable results; but I established this fact, that by sowing my grass-seed, I got an excellent sward for

the next year's crop. Still, I have harvested one crop of clover, of a ton to the acre, from that field. This plan requires a certain amount of faith, which every farmer is not willing to exercise. He is afraid that his grass-seed will be overpowered by the weeds, and I know that that is discouraging, but nevertheless, if he will put on plenty of manure, he can sow his grass-seed in the spring and reap a good crop the same year; and, under favorable circumstances, two crops.

In regard to this summer-fallowing, to which my friend, Mr. Lewis, has referred, I see no necessity for losing a crop of grass on account of ploughing up a meadow. The custom that prevails with us is to plough the meadow after having taken off the grass-crop as soon as we get through haying, say the first of August, and by the first of September cross-plough it, harrow it down a very little, and in the fall plough it again and leave it in a rough state to the action of the frost. The next spring, that land will pulverize like an onion-bed, with one of these patent harrows, and early the next season it will do to seed, and by a liberal application of manure we can secure a good crop, and are not under the necessity of losing a crop in order to restore new roots to the grass.

Mr. Hawes, of Fairhaven. I remember, a short time ago, I heard a story about two boys, one of whom had told the other rather an improbable tale, and was met with the reply, "It isn't so." "Yes it is, too," said the other; "it's true, for my mother said it was true. If it wasn't true, if my mother said so, it was true." Now, I find myself very much in that position. In that portion of the State in which I live we do not have much snow to cover the roots of our grasses, and we have to rely either upon purchased fertilizers or fertilizers which we produce ourselves. I am one of those unfortunate fancy-farmers of whom you sometimes hear; but we fancy-farmers want to know the truth as well as the other kind. We find the truth of the bills when they come in. But those of us who are interested in the land want to know what is the best thing to be used generally. One man will tell us, as our friend from Herkimer tells us, that mud and water make a good fertilizer. Now, will mud and water suit the south-eastern, central and northern portions of Massachusetts, or

is it applicable only to Herkimer County? We want to know what is the best thing for all farmers to use. Here I find there is a great deal of snow on the ground, and there will probably be more during the season. For the last three or four years, in the vicinity of New Bedford, we have had hardly enough snow to get a sleigh out. We cannot rely on having the grass-roots covered by snow, which is sometimes called the poor man's dressing, and if there is any one here whose knowledge of the different portions of the State is sufficient to enable him to give us information which will be applicable to farmers in every portion, I, for one, would be very much pleased to hear it.

Mr. ROOT, of Barre. This grass question is perhaps the most important to the farmer of any question that can come before him. The grass-crop of New England surpasses all other crops in importance to-day. The question of what we shall keep our cattle on during the winter, and what we shall feed them with during the summer months, is more important than all other agricultural questions which can come before us. The difficulty in prescribing just what should be done in every case grows out of the fact that the cases are all so very different. What may be a good application for a man living on the sandy beaches of the shore, may not answer up in Berkshire County, may not answer over in the Mohawk Valley. I believe t e doctrine of my friend from Herkimer County is the true doctrine, and will apply to every individual case, that water and mud are healthy for grass. My own observation teaches it wherever I have seen it tried. I remember in my boyhood days my father dammed up a brook that ran through a meadow, and turned a current of water during the winter months over a piece of land that had hardly the slightest vegetation, and in a short time by throwing on fowl-meadow grass-seeds, and the seeds of other water-grasses that grow in the low lands, a thick coating of grass came up, over which you might drive a heavily-loaded team. A friend of mine was looking over my farm in Barre a few months ago, and I was telling him of the unfortunate condition our farming-land was in, owing to the drought of the past few years. Said he, "Can't you irrigate?" Said I, "I have no springs on this high land." This friend had been

living for a number of years on the western slope of the Andes. Said he, "It never rains there, but the crops are produced by irrigation." "Well," said I, "if I only had the mountain-streams that come down from the Andes to run over my farm, perhaps I might do it." That suggestion, thrown out by my friend, is worthy of consideration; wherever we can possibly collect a reservoir of water in the proper season of the year, let it be meadow-land or let it be sand, distribute it over that land. It is the cheapest fertilizer; it is something that can be applied everywhere, and it will do an infinite amount of good.

One word about this summer-fallowing, for I believe in that. Some of us over in Barre have had to do that, in order to eradicate witch-grass, a troublesome grass which we do not like. We find it pays to turn up grass-land in June, and fallow it. The land is not exhausted; it is brought up to that condition which our friend, Mr. Lewis, illustrated so clearly, where all the infinitely small roots will take hold and feed fast.

One word about seeding. We sometimes get discouraged, because, when we sow our grass-seed in the spring with our grain the drought kills it, so we do this: Late in the fall, just before the ground freezes up, or early in the spring, on the last snows that come, we throw on abundance of grass-seed, and let it alone. It grows and does nicely. I have tried it in many cases with good results. Then, again, here is a piece of land where the grass is apparently killed out, in our pastures or in our mowings; sow on grass-seed and let it alone; it will grow and do well. On our hillsides, where we cannot plough, throw on white-clover or any kind of seed you please in the spring, and it makes a beautiful grass-plot. You will notice, as you go over your ploughed land, that it is all honey-combed, heaped up in little ridges which the frost has left there. Beautiful places they are for grass-seed; throw it on early in the spring and level it down, and I will warrant you that it will grow in ordinary seasons.

Mr. Phinney, of Barnstable. I do not know that I shall be able to throw much light on this subject. In some sections, the gentleman from Herkimer tells us, sand serves to produce grass, and in confirmation of that, I will say, that it

is producing grass with us where the meadows and swamp-land are cultivated. We are producing remarkable effects on such lands with the cranberry. The sand which is carried on our low, swampy meadow-lands is producing wonderful effects, without any manure at all. Hundreds of acres in my own section of the State have been brought into cultivation within a few years by means of the sand that is carried on the land to the depth of three or four inches. So great has been the improvement, that, in one or two cases where we have been cultivating the cranberry instead of grass upon this low land, we have taken one hundred bushels of cranberries, worth $1,200, from an acre. That is what sand is doing in that section of the State.

We have also tried sand upon our meadows, and it has produced wonderful effects even there. I have been for some years cultivating a low piece of meadow, where I could not, for a long time, except by draining, get on with a team at all. Finally, after draining, I was enabled, in the month of September, to get a plough in there, and I have cultivated that piece now for two or three years or more with crops. I was enabled to turn over a piece of low meadow, after draining it; then I put upon it my sand, and sowed what compost I had; and then I put upon that, in the month of September, my seed, and it took root during the fall. And, mind you, this was land that was filled with roots; it was a swampy, marshy meadow, filled with swamp-roots. I covered this so deep that the grass took in the autumn, and the next season I had as fine a crop of grass as could be produced in almost any portion of the State. That continued for several years. By and by, as good luck would have it (as they tell us that "it is an ill-wind that blows nobody any good"), a cargo of Peruvian guano was wrecked upon our shores, and I got several tons of it. I put one ton on this land, after I had sown it down for five years, and it has never been turned up to this day. It is more than ten years since I put this Peruvian guano upon it. Some of the herdsgrass which was grown upon this swamp-meadow, which had produced little or nothing before, stood higher than my head. This is my experience in cultivating grass. While my neighbors have been producing cranberries on their low lands, I have tried grass

and cranberries with equal success. A small town of only three thousand inhabitants has this year marketed over eighty thousand dollars' worth of cranberries, showing what may be done with lands which can be cultivated in this way. One acre is sometimes worth half a dozen acres of drier land, which requires so much labor to fit it for a crop. I think myself, that if we have this meadow-land, or land that is apparently filled with briers and roots, if we can go in and drain it, and take proper care of it, we shall find for the most part, a reward for our labor.

Mr. WAKEFIELD, of Monson. I would like to ask Mr. Root, if witch-grass can be killed entirely by ploughing one summer?

Mr. ROOT. I think it can, judging from my own experience and that of my neighbors. By ploughing the land early in June, I think it is most easily subdued. If you turn your green-sward over then, I think it will decay quicker than when turned over in May. By following it up with the plough and with the harrow, through one summer, I think it can be thoroughly killed out, judging from my own experience and from the observations which I have made on Mr. Ellsworth's farm. You all know that witch-grass is a very strong grower; it has a large, strong root, and is not easily killed. Right here I want to say, that I believe we have been imposed upon by seedsmen who have sold us bad seed. I believe it is the duty of the Board of Agriculture of Massachusetts to look after this very matter, if it can be done. I know that grass-seed, sold for timothy in Boston, has been largely mixed with witch-grass seed. It has been sown where no witch-grass was ever known, and the witch-grass came in thick. Consequently the land had to be ploughed up, and it took a whole summer to kill it. I believe that grass-seed which we buy in the market is not pure, and I think this is a matter which needs to be looked after.

Mr. ELLSWORTH, of Barre. I have tried summer-fallowing and killed witch-grass to my satisfaction; I have made a success of it. Many of you doubtless understand what witch-grass is. It is among the worst of our enemies; but it can be killed, if it is rightly treated. It is a very vigorous, strong grower, and it will kill out every other kind of

grass that grows with it, and then it will turn round and kill itself out. On a deep soil, in rich, mellow, moist land, it will thrive wonderfully. I have cut sods that for two or three inches deep were nothing but witch-grass roots, and when it was in the right state to shake the dust out, there would be twice as much bulk of roots as there was to begin with, showing that it was about all roots. I have tried several different ways to kill it, and have found that the best way is to turn the ground over in the spring and sow it to fodder-corn, scratching in a little manure. If you can possibly cover the corn with dirt, it is best to do so. Sow it in the season of the year when it will grow the best, May or June. You get the fodder-corn started and it will keep down the witch-grass. As has been remarked by one gentleman, it is pretty hard if ploughed in June, to cross-plough it that year. Mr. Lewis can do it on his land, but it cannot be done on land that is filled with witch-grass. After you get your corn off, it can be cross-ploughed the same fall, and the season following, there is no trouble in killing it by ploughing just as often as it comes above ground, or harrowing once a fortnight or ten days, or doing anything that will disturb it. In this way you can kill it perfectly, so that you will be able to seed the land down the fall following after you have got your crop of fodder-corn. By turning over the sod and covering it, you will kill it effectually. It wants sun and air; it cannot live without them, any more than we can live under water. I have tried it, and know that you can kill witch-grass by summer-fallowing. The worst trouble that I have found with it, where I have followed it up so closely that the witch-grass was killed out entirely, was that the ground was all dust; and if there was the least slope to the land, with such showers as we have had for two years, the wash was tremendous, because it would be smooth, like a floor, and if there was nothing more than the soil to hold it, it would wash badly. I have concluded that hereafter, when I take up a piece to kill the witch-grass in that way, after it becomes fine, I will sow it to oats. These will sprout very quick at that season of the year, July or August, and they will hold the soil from being washed away by the heavy showers.

As regards the question whether we lose the use of our

land and labor, I think it is a benefit rather than an injury. If any of you who have a piece so full of witch-grass as that, if you will kill those roots, you will have something that will answer the same purpose as manure. To illustrate that, I will state that I raised sixty-four and one-half bushels of winter-rye on one acre of this piece of land that I summer-fallowed, and got a good growth of straw with it. I guess I could not have done that by simply turning the sod over and seeding down.

Col. WILDER. Has any gentleman had any experience in turning over grass-lands after he has ploughed in the summer with a Michigan plough, harrowing lightly, and seeding down the same season?

Mr. LEWIS. I can answer that. I have repeatedly turned over a poor sod and have made a fine, nice sod, by seeding at once with the old sod undisturbed. But, if I had land that was foul, either with this witch-grass, Canada thistles, bushes, brakes, or anything that was obnoxious, I should prefer, by all means, this summer-fallowing. It fits the land the most perfectly for the reception of seed of any treatment that I ever saw bestowed upon it, and the crop is almost sure to grow. By summer-fallowing you prepare an immense amount of food for the grasses, and in its most available form for the grass-roots to reach it. There is no loss, I think, of time. When you count a number of years forward, I think there is a gain of at least a year in thorough summer-fallowing. But you can turn land over and seed it almost any time of the year. I have sowed every month in the year, except December, January and February. I sowed grass for several years with crops, supposing that I had got to sow a crop if I sowed grass-seed; but for twenty years I have not put anything with my grass-seed when I re-sowed it. I give the grass-seed full sweep, and I find that I can seed as late as the 28th of May, and get a very good crop of grass by the 28th of September, turning the sod right over. But, as I said before, I am sorry that this friend of mine regards it as the loss of a whole year. I repeat, I have never seen any treatment of land equal to that of thorough summer-fallowing for a permanent meadow or permanent ploughing. Nothing that I have ever seen will prepare the land so well.

Adjourned to half-past seven.

Evening Session.

The meeting was called to order at seven and a half o'clock, by Captain Miles, the large hall being completely filled.

THE STRUCTURE AND GROWTH OF DOMESTICATED ANIMALS.

BY PROFESSOR LOUIS AGASSIZ.

Ladies and Gentlemen:—In the lecture which I delivered last year, at Barre, I began some remarks upon the growth of our domesticated animals. It is intended that I should this evening continue the same topic. It covers so wide a range of information, that to give even a brief sketch of the whole subject in an evening's address would be impossible, and I hope you will pardon me, therefore, if I dwell more fully upon one part of the matter in hand, and repeat only as much of what I have already stated as may be necessary for an understanding of the facts to be illustrated, closing with a rapid outline of such aspects of the question as may come up for fuller treatment on another occasion.

I wish I could lay before you finished results, such as were presented to us this afternoon upon the motions of the sap in the plant. Unfortunately, in the field upon which I intend to enter now, I am only a pioneer, and a pioneer upon a ground which has hardly been touched. A vast amount of information has been collected concerning the growth of animals, but about those most interesting to man, and about man himself, we know least; so that the presentation of the subject, as it is introduced in our text-books and books of natural history, is largely borrowed from investigations upon other animals. The fact is, that with reference to the embryology of our domesticated animals, we are doing now what physicians were obliged to do with reference to disease centuries ago, when dissections of the human body were looked upon as something fearful, not to be thought of. All the information which the surgeon could then bring to his aid in the treatment of his patient was derived from the observation of animals. It is only a few hundred years since the frame of man began to be the subject of careful investigation, and our knowledge is still

very incomplete, while with reference to our domesticated animals we are even more in the dark. Not that objection is made to dissecting a dead animal, one which has died upon the farm,—the scruples do not go so far as that,—but there is an objection to the examination of the living animal, first, on the ground of the possible suffering, and secondly, on another ground, touching everybody even more nearly perhaps, namely,—the cost of the experiments. We may examine the embryos of rabbits repeatedly without draining our pockets, but if we would study the early condition of the germ in our more valuable animals, we meet at once with this almost insuperable difficulty, that we must kill a large number in order to have specimens enough to carry on such researches.

The natural consequence is, that to this day, I do not know one physiologist who has traced the growth of any of our more valuable domesticated animals. The highest and the most costly of which we know anything, is the dog. Even the sheep has not been investigated, nor the goat, nor the pig. Of the cow and the horse we know almost nothing, except by inference, although we understand in a measure their organs, and the functions performed by them, some dissections having been made to elucidate that part of the subject.

It must be understood, therefore, that whatever I say of the growth of these animals is inferential,—based upon the development of other animals more within the reach of investigation, to the embryology of which our knowledge of comparative structure enables us to give a wider application. I am the more anxious that you should appreciate this difficulty, because we shall never fill the blanks in our information till the opportunities so much needed are given to future students. It is not even enough to know the difficulty, and be ready to meet the expense of further investigation; you must also prepare the observer. You would hardly believe me when I say, that there are very few naturalists in the United States competent to make such an investigation; and yet this is literally true. I will add that of those able to do the work, not one is placed in a position under which he could undertake it. Those who are capable of such researches are so overworked, so overloaded with duties, so cramped for a

little leisure and a little means to devote to their own science, that they could not, even had they the material, carry on a series of investigations such as is demanded. We can, however, make a beginning in applying the science of embryology in its present condition to the improvement of our breeds. This has become a matter of importance, not only to the farmers, but to scientific men. The information demanded on the farm must first be worked out, and institutions must be founded and organized in which this work can be done. This is the plain fact, and it is a want which can only be met by gradual and slow degrees. You will see the importance of this investigation if you consider what is at stake, and the advantage you farmers would derive, if you could bring up heifers, or bulls, for instance, at your will, or if you could adapt your farming to the kind of soil you have about you. It would change your fortunes, and would not only make a material difference to you, but would entirely re-model the conditions of stock-raising. It is therefore unquestionably worth your while to remember that the means of making the necessary experiments by which any modifications in the products of our breeding may be brought about are not at hand.

What is there then to be done? In the first place you must educate the observer, so that he shall be able to avail himself of every opportunity afforded; and that education is in itself almost a life-long study. The embryologists of our time can be counted on the fingers of one hand. There are a few in Germany, hardly one of eminence in England, there is hardly one in France, and here we have none. Do not think that this work can be done lightly. As well might you study astronomy with an opera-glass, substituting an instrument worth a few dollars for an observatory with its outfit, as study embryology in a common stable. Such researches require for successful results, the apparatus of a physiological institution, and the combination of varied talents.

Notwithstanding what I have said, we have upon the cheap kind of animal life surrounding us, a good deal of information, and that information is not only very interesting in itself, but may be partially applied, and must indeed be applied, in default of anything better, to those animals in which we have a greater interest.

On a former occasion, I have already stated before this Board, that all animals, even the highest, mankind not excepted, are reproduced through eggs, and that those eggs have the same structure throughout the animal kingdom. Your idea of an egg will be very incorrect if it is derived only from birds' eggs. Indeed, they are, on the contrary, exceptional in structure. Few animals produce eggs like the birds. Their egg is surrounded by a hard, brittle shell, and though there are other animals whose eggs have a hard shell, there are very few outside the class of birds, the shell of whose eggs is brittle. The bird lays its egg in the form which it will retain until the young breaks through the shell and appears as a living animal capable of providing for itself, or of receiving nourishment from its parents. In other animals the egg grows and increases considerably in size, even after it is laid; at least, this is the case in many other animals. You may often have noticed it in some of our turtles. Our snapping-turtle lays eggs which are about the size of a small walnut. Examine them during the summer, and you will find that they enlarge to nearly twice the size before the little turtle breaks through; the hard shell expanding as well as the whole egg. What is so palpable in the egg of the turtle, is more or less so, and may be ascertained without great difficulty, in the eggs of almost all other animals. If you have ever watched the strings of eggs laid by toads in pools of water by the road-side, you must have perceived that the eggs are rather small at first, and afterwards acquire a diameter twice as great. So with the fishes. When first laid, the eggs have not half, some of them not one-quarter, the diameter they acquire at a later time, before the young is hatched. Here, then, we have one marked peculiarity of the egg, namely, that it enlarges as it grows. If we except birds, in which the rigidity of the shell prevents any such enlargement, this is true of the eggs of most other animals.

I will not allude to the different phases in the formation of the egg, as I described them very fully in the lecture last year; but I must repeat so far as to say, that these eggs, however varied when adult, are identical as to size and appearance about the time when the germ begins to be formed. They are at first microscopically small, growing slowly and

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steadily until they reach certain dimensions. This growth consists mainly in the enlargement of the yolk, which is the essential part of the egg; in fact, the yolk is the living portion of the egg. It is that which from the beginning, is increasing; it is that in which all the changes take place preparatory to the formation of the germ; it is through the yolk that the substance of the young is made; it is in the yolk and with the yolk that the growth begins, and it is through the transformation of the yolk that the body of the new being is brought into its peculiar condition as a germ, and finally acquires the character of a new being like its parent.

One point in which eggs differ most is their size. In the highest animals, in all the mammalia, that is in all warm-blooded animals bringing forth living young, the eggs are exceedingly small, so small as hardly to be visible to the naked eye. Only a well-trained eye can perceive the egg of a rabbit or the egg of a dog, at the time it has completed its growth prior to the formation of the germ. Examine the egg then, and you can still hardly distinguish it, even after a good deal of practice, from the egg of the hen or of any other bird, at the same stage, or from that of a reptile, turtle, serpent or frog, or from that of any fish, or indeed from that of any other animal, be it the crab, the lobster, the oyster, the polyp, the jelly-fish, no matter what, in the whole animal kingdom. You will find that at a certain time the eggs of all of them have identically the same structure. Now, these eggs grow to certain dimensions, and during that growth, undergo changes which prepare the formation of the germ. What are those changes? They are vital processes within the yolk; changes in its substance going on under no external influences except the raised temperature to which some eggs are submitted during incubation, or during gestation. It is a marvellous process, that of this inner life of the yolk, leading to a result so extraordinary as the formation of a new living being. Physiology, as we learn it in our books, made up as it has been from the study of adult animals, gives us no idea of such a mode of growth. We are accustomed to see an animal growing when it is fed. It takes in food; that food is digested in particular organs; there is a stomach, an alimentary canal, through which the

food passes, and during that passage is so worked up as to yield to the animal those particles fit to be appropriated by the new body, and become a part of it. But a growing germ has no alimentary canal, and yet it grows. In the adult animal, the food thus elaborated is absorbed, passes into the blood-vessels, and is circulated through all parts of the body. This fluid, resulting from the action of the alimentary canal, and circulating in the blood-vessels, is the nourishing fluid upon which the animal is properly fed. By this fluid are produced all those secretions which are elaborated by the body. But the germ has no blood; it has no vessels, it has no heart; it has no circulation; and yet it grows. Nor does the difference stop there. An adult animal which digests, and circulates the nutritive food, breathes; that is, this fluid is submitted to the influence of the atmosphere, exchanges some of its parts, takes in some, gives out others, and, in that way, the whole organism is maintained in a condition fit to keep it alive. But in the germ there is no breathing, there is no organ of breathing, and yet it grows.

We must learn a new physiology before we shall understand the development of the germ. We have here a living being, destitute of organs, yet growing and performing all those functions, which are carried on later through distinct sets of organs. It is something marvellous. It has taken investigators half a century to understand that such a thing could be. When I was a student, there were still physiologists who maintained that all the organs necessary for the maintenance of life existed in miniature in the germ; that they grew as the germ grew, and performed their functions as they enlarged. They would not give up this idea until they were forced to do so by the demonstration, under the microscope, of the condition of the germ in its earliest stages. All then admitted that a particle of yolk, imperceptible to the naked eye, hardly visible with the highest magnifying powers of our best microscopes, was an incipient new living being, capable of maintaining its life, and of passing through a succession of changes, by which in the end, it built its own organs, developed them, so as to enable them to acquire and perform their functions, and finally to manifest life as it is seen in the adult animal.

I propose to show you, as far as it can be shown without a specimen in hand, how this is brought about. The process has been observed in a large number of cases. Its limits and various modifications in different animals are extensively known, and were it not for our ignorance of the process within these very creatures, which have for us such a special interest, we might congratulate ourselves upon our results.

As an illustration recalling something with which we are familiar is more impressive, perhaps, than an allusion to things less known or less frequently seen, I will take my description mainly from the egg of the hen. Suppose you remove from the egg, first, the solid limestone shell, then the membrane lining the shell, and lastly, the second or inner membrane immediately surrounding the yolk. A separation between these two membranes at the blunt end of the egg forms the air-chamber. The air-chamber is full of a white substance capable of coagulating under heat, and possessing all the properties of albumen; in fact, it is living albumen. This brings you to the innermost part of the egg, where you find a sphere of yolk about the size of a walnut. This sphere has grown gradually to its present condition by the multiplication of those infinitely small organic elements which physiologists call cells, and which are, as it were, the bricks out of which the living structure is built. These cells multiply by producing new generations of cells within themselves; which are then set free by the bursting of the outer envelope, and in this way the yolk is constantly increased in bulk. This process goes on all the time while the yolk is forming, enlarging, and transforming itself into a new being.

The yolk is suspended within the second or inner membrane by two strings of white, a little firmer in consistency than the rest of the albumen, and it swings upon these two strings in such a manner as to retain always the same position. On one side of the yolk, when the egg has been laid, you may see, on opening the shell, a little white speck; that is the beginning of the germ; naturalists call it the blastoderm. I will rapidly explain how that is formed. The whole yolk, as I have said, consists of myriads of minute cells,—each of which is in itself a complete organism. Every such cell in its most perfect condition is a spherical body, containing a

transparent fluid, within which floats another smaller bag, and in that another still smaller, which is perhaps more compact, though it may also be hollow. This transparent fluid may become slightly granular, or cloudy in appearance. Apply to it a high magnifying power, however, say of two thousand diameters, and then we shall find that this cloudy fluid resolves itself into grains, each of which is a hollow bag resembling the larger cells. In fact, the egg itself, at first a mere granule of yolk, hardly yet observed in its internal structure, is in a later phase such a cell as I have described.

It is now generally understood that all animal substances are but the result of the multiplication and increase of such cells, which assume different forms, different consistency and various combinations, being peculiarly modified and adapted to every organ. Bone is nothing but an accumulation of cells of very irregular form, in which limestone particles are consolidating. Flesh is nothing but elongated thread-like cells, confined together in bundles. Cartilage is nothing but a combination of cells, having thicker walls, of a more transparent character. Every substance, in short, of which the body in its adult condition is composed, be it brain, tendon, flesh, blood, bone, skin, or the fluid secreted by the various glands (unless they are merely material to be thrown off from the body), are but various cells in their numerous modifications, having their marked peculiarities in each substance, but when first forming, exactly the same in all. Up to this time the cells are alike, and are scattered uniformly throughout the whole mass of the yolk, but by an impulse within the yolk itself, neither modified by nor allied with anything else,—by an internal impulse, in short,—these cells at a given time begin to multiply more rapidly on one side of the yolk than on the other, and as they multiply, they become also smaller; that is, the new cells produced are smaller than the older cells from which they are derived. These new cells accumulate upon one side of the yolk and form a little whitish speck on its surface. This is the beginning of a new being. It is so merged in the rest of the yolk as hardly to be distinguishable from it. You cannot mark the boundary between that field of individualized cells and the adjoining yolk. Examined from above, it is seen to be a hollow sphere, somewhat more

dense in the centre, and fading towards the periphery. Evidently, the smaller whitish cells composing it, are more crowded toward the centre than near the periphery; they are in larger number, and disposed in more numerous layers than they are on the margin. On its lower edge it melts into the other cells in such a way, that the point where it ceases and the yolk begins, could hardly be marked.

Now, that layer enlarges; and as its circumference extends it increases also in thickness, covering a larger surface of the egg, and penetrating to a greater depth within the yolk, but still with indistinct limits. An increase in dimensions in every direction is thus far the only change; an additional thickness toward the middle and an enlargement around the margin. Next it alters slightly in form. Instead of being circular, it is somewhat oblong, and one end is blunter than the other. As this modification of the outline goes on, the thickness becomes less uniform throughout. Two parallel ridges arise upon the sides of the germ, at equal distance from the middle line. This phase is generally represented as if a longitudinal furrow were forming along the germ. It is a furrow, if you will, but it is the result of the depression enclosed between the walls formed by these parallel ridges. All this goes on by an impulse, of the nature or cause of which we have no conception. It is easy to watch the growth of an egg so as to bring this process, in its successive phases, before the eye. You need only place your eggs in a breeding-machine, marking the hour at which you put in each egg. You may thus know exactly how old the germ is, how long the transformations have been going on, and as the chronology of this growth is well ascertained, being familiar to embryologists, you can take out of your machine an egg at any stage and examine its condition, knowing beforehand, from the record made of all these facts, in what period of development you will find the germ.

As these ridges rise in height, they do not remain just parallel, but diverge, as it were, on one side, and so diverging the layer itself widens on that same side. This divergence gradually increases, and as it increases, instead of being a mere curve, it begins to be undulating. Now, this germ has already two ends distinctly differentiated, while

the two sides correspond to one another. A symmetry is thus established, but there is as yet no head, there are no limbs, there is no tail, neither can we recognize the sides of the body-wall, though we see that there is something coming. All this is brought about without any help from organs such as we recognize in the adult animal. There is as yet not even a drop of blood, nothing but a modified yolk, no longer yellowish, but rather milky in appearance, and somewhat more translucent than yolk. Presently, something quite startling in character begins outside. Dots make their appearance, and these dots move. They change places, they cross each other, they rise and fall, jumping and hopping about often with a jerky motion. In all this movement, even under a high power of the microscope, no fixed tendency, no given direction is perceptible. They are only rising and falling, heaving and subsiding. These dots are still yolk. They are perhaps of a little deeper yellow then yolk; you might almost imagine them to be particles of blood; but on careful examination you see no vessel and no indication of a regular current flowing to and fro. Presently, in the midst of these leaps, this heaving and falling, one dot may be seen to turn around another, and this may be repeated at different spots; two dots not very far apart may exchange places, the one which is here may presently be seen there, the one which was there may presently be seen here, and after a while the whole yolk seems to be disintegrating, breaking up. Instead of holding together, it looks as if it were crumbling to pieces. After awhile the moving particles on one side march in one direction, and those on the other march in the opposite direction, passing on until they are brought under the germinative layer. This is, in fact, the first sign of circulation. But there are still no vessels, no channels. They run as dirt will run after a rain over the surface, or as gravel may be carried by a heavy shower into open channels. Thus running, they perhaps form a puddle in one place; this pool increases in dimensions, and presently a stream shoots out from it in one direction, and this stream unites a little further out with another, formed in the same way. Now you have circulation, but it is not yet blood, nor are these channels closed. They are simple furrows in the substance of the

yolk. As yet it is only yolk flowing through yolk, though the flowing yolk is somewhat different in appearance from that which surrounds it, and which afterward builds up the walls of the vessels. Meanwhile, the walls of the longitudinal furrow, formed by the rising ridges along the middle line of the germ, meet and unite, thus transforming the open furrow into a close cavity. One end of this cavity becomes somewhat wider then the rest and has lateral undulations. Within this portion of the cavity is hereafter to be the head.

At some future time, long after the period I now describe, there will be not only a brain forming in this front cavity, but also all those parts which constitute the head and connect with the spinal-marrow, which is enclosed in the straight and narrow part of the cavity. The lower edge of the embryonic disc goes on increasing, extending gradually downward over the yolk until it has taken in the whole mass, closing over it so as to form the walls of another cavity below; this cavity, though it is now full of yolk, and contains nothing else, will in the course of time be transformed by a series of changes into a mouth, lungs, chest, abdomen, in short all those organs of respiration, digestion, etc., by which life is maintained. But as yet, I repeat, it is nothing but a bag full of yolk, enclosed in a bag of yolk-cells, which have undergone certain slight changes from their primitive character. The upper cavity is nothing but a channel formed by the ridges on the surface of the germ, which have become united along the middle line. The channels of moving yolk arising from a pool, here and there, are only gradual depressions in the yolk-mass, slowly covering or enclosing themselves with yolk-cells, or with a yolk of a peculiar kind, which forms walls around them. Suppose that water flowing through a rut on the ground, after a heavy rain, should line the walls of that rut with mud, so as to consolidate the rut, and that with every rain this process should go on always increasing and strengthening the consolidation, you would then have a process resembling that through which these channels of fluid yolk are transformed into vessels, into closed tubes, circumscribed by the coherence of minute particles of the fluid itself, which adheres to the sides of the channels, and changes what were at first mere ruts into the closed cylinders, aque-

ducts, or ducts which we call blood-vessels. The chick has now a heart, and that heart begins to contract, to heave and fall, so that the fluid within is pressed out and a relation begins between the heart and the channels outside. Through these channels, which are still open, a certain amount of yolk is constantly moving and falling into the current, and it is this yolk which is transformed into blood. This process goes on so rapidly that by the time the parts have reached the phase in which I have described them, the fluid is tinted with reddish blood-corpuscles. These blood-discs are only modified yolk-cells. They have not the character of perfect blood; they have not all the characteristics of that blood which we make from our food, when it passes through the vessels into the respiratory organs, and is there transformed into regular blood-discs. In all this we have nothing, I repeat, but the transformation of yolk, through its own agency, into a variety of substances derived from the yolk itself, and so distributed and differentiated as to build up a frame having all the properties of the parent animal from which the yolk is derived.

Here is something wonderful! Not only the simplicity of the process, by which these changes are brought about, attracts our notice, but still more marvellous is the fact that all this goes on from within. There is a principle acting by the aid of the substance which holds it, never deviating from its course, and always leading to the reproduction of a being like the parent. How that influence from the parent is transmitted, there and then, how and what the nature of that transmission or that impression is, stamping, as it were, the new being so indelibly with the character, with the peculiarities of its parents, sometimes even with their idiosyncrasies, with those family features in short, or those features of breed, etc., belonging to the individual, these are matters about which we know nothing whatsoever. These are the questions we must now study, by attempting more refined investigations than those which we have been able to carry on to this day. We must try to seize the moment when these peculiarities are imparted to the new being, in order to know how to influence reproduction at that time; for unless it be done then, it can never be done. It is by a knowledge of what takes place

there and then, under those circumstances alone, that we can hope to have any influence upon the reproduction of our domesticated animals.

I think I have shown you plainly enough that our farmers must study embryology, at least those of them who mean to influence and improve the raising of stock, and impart their knowledge to their fellow-workers. Of course it is not expected that every farmer should be able to analyze the products of the farm chemically, but let there be in the agricultural college one who can do it, and do it well. It is not expected that every farmer should learn to use the microscope, and to make physiological experiments, but let there be in the land, in some institution at least, one man who knows how these things should be done, and who is placed in a position to do them. This is not the case now. When we have that man, we shall be prepared to talk of improvements in stock-breeding, not before.

Adjourned to Thursday, at ten o'clock.

THIRD DAY.

THURSDAY, Dec. 4.

The Board met at ten o'clock, A. M., Col. ELIPHALET STONE, of Dedham, in the chair. The first subject presented for discussion was a paper on

THE HUMANE DESTRUCTION OF ANIMALS.

BY PROF. D. D. SLADE, BUSSEY INSTITUTION, HARVARD UNIVERSITY.

Mr. Chairman and Gentlemen:—It is the object of my present paper to give instruction to those who desire to terminate the existence of animals in the most speedy and humane manner, whether such animals are intended for food, or whether they have become useless through age, sickness, or other cause. When we reflect upon the vast number of animals which are put to death in our own country alone, for food,—a number estimated at more than fifty millions every year, not to speak of the thousands that are destroyed for

other reasons,—and when we bear in mind that the great proportion of these animals are put to death with the most needless cruelty, simply through ignorance of the proper method of producing speedy death, it will be readily admitted that any attempt to enlighten the public in this respect, may at least serve to diminish the amount of such cruelty, and indirectly lead to other equally satisfactory results.

While I write more especially for the farmer, who is from circumstances obliged to slaughter his own animals, and for those who are called upon reluctantly to rid themselves of some fond disabled pet, I also desire to call the attention of those who pursue the slaughtering of animals as a business, to the great necessity of doing their work in the most humane manner possible. To this end, there are certain measures of importance to be kept in view, and to be carried into practice.

Thus, the animal to be slaughtered should be conducted to the spot selected as quietly as possible, without the use of goad or club, and everything calculated to alarm him should be removed.

All slaughtering premises should be kept thoroughly cleansed, and no carcasses should be allowed to hang in view. No animal should be permitted to witness the death of another. Trifling as these measures may appear to the professional butcher, they are in reality of vast importance, not only in view of avoiding useless cruelty, but as affecting the wholesomeness of meat for food, and the market-value of the animal slaughtered,—there being no question as to the effects of torture, cruelty and fear upon the secretions, and if upon the secretions, necessarily upon the flesh.

The slaughtering of animals for food at the present day may be classified under three methods: 1. Rendering the animals insensible by a blow on the head, followed by bleeding; 2. Cutting through or injuring the spinal cord (pithing), so as to destroy the powers of motion and sensation, with subsequent bleeding; 3. Cutting the throat deeply, dividing all the blood-vessels, with or without thrusting the knife into the heart, and without previously stunning the animal. This last method is practised by the Jews in slaying cattle.

From certain experiments conducted for the purpose a few

years since in the abattoirs of Paris, it would seem that the first of these methods, namely, that of producing insensibility by some sudden shock to the brain, such as that of a direct and concentrated blow, especially if followed by immediate blood-letting, is attended by less suffering than when death is effected by decapitation, pithing, or cutting the throat without previously producing such insensibility.

A German observer* remarks upon this subject: "All methods of slaughtering have for their object the death of the animal in a more or less speedy, but always in the least painful manner possible. But what is death? and when does actual death occur? Simple as these two questions may appear, they are nevertheless very difficult to answer. A mammal whose head has been cut off by a guillotine does not die immediately. Actual death occurs some seconds or minutes afterwards. All methods of slaughtering than the one in which insensibility is produced by a severe shock to the brain, followed by bleeding, produce, without exception, only apparent death, after which follows the actual death, the latter being always accompanied with an entire cessation of nervous and muscular excitability."

There are two kinds of motion. The one is voluntary and dependent upon the brain. So long as this organ remains unimpaired, so long will consciousness, sensation and the power of voluntary motion continue. The other is involuntary, and dependent upon the action of the spinal cord as a nervous centre, and is known as reflex action. This kind of motion is exhibited in the movements of animals after decapitation, where all connection with the brain and consequently with consciousness, has been cut off.

In witnessing the slaughtering of two animals we are naturally inclined to attribute the greatest amount of suffering to the one which struggles most, so intimately connected in our minds are pain and action. This, however, by no means follows, for it is possible that there may be acute suffering without exertion on the part of the animal, and on the other hand there may be much action, and even distortions without pain, as is constantly seen in cases of decapitation where as I have first remarked, all connection with the brain has been removed.

* Dr. Sondermann of Munich.

Thus we see that the movements of an animal in the act of being killed are not at all to be relied upon as evidences of pain.

The term "pithing" is applied to two methods of inflicting injury to the nervous system, and thereby producing death. By one method, that most commonly in vogue, the spinal cord is severed or punctured between the first and second bones of the neck, where the peculiarity of the articulation leaves an opening. This is done by a variety of instruments. Although the animal drops immediately, life continues for some seconds and even minutes, the heart continues to beat, and the brain to live and act. By the other method, a small spot situated in the lower and posterior portion of the brain, known as the "Medulla oblongata," is reached and broken up by the introduction of a narrow, sharp instrument through the occipital hole. Death is almost instantaneous. "No attempt is made at inspiration, there is no struggle, and no appearance of suffering. The animal dies simply by a want of aëration of the blood, which leads in a few moments to an arrest of the circulation." * Both of these modes of slaughtering, especially the last, require an anatomical knowledge as well as practical dexterity that but few would attain, and if they are not properly and quickly executed, are undoubtedly attended by more suffering than other methods.

Without entering further into the consideration of physiological questions of so much importance, we may with safety lay down the following proposition :—

All animals when slaughtered should be deprived of sensibility, by inflicting sufficient injury to the brain, either by a sudden and violent blow of an axe or hammer, by the bullet, or by some other equally efficient means, and should then be bled during the state of insensibility.

It is important to know the exact situation of the brain in animals, so that the shock to this organ may be conveyed effectually and at once, and not by clumsy and ill-directed efforts, as is too often the case.

It should be kept in mind that the brain of animals occupies but a comparatively small portion of the entire head.

* Dalton's Physiology.

In the attempt to fell them, the tendency is almost always to strike too low. Fig. 1 represents a longitudinal section of the horse's head, showing the situation of the brain, and also the thinness of the frontal bone (Letter a) as compared with the corresponding region in the ox (Fig. 3).

The horse may be destroyed by blows upon the head, by the bullet, or by chloroform.

1. *By Blows.*—Having led the animal to a suitable spot, blindfolded, and secured him by the halter, the operator, armed with a heavy axe or hammer, should stand upon the left and to the front of the animal, directing his blow to a point in the middle of a line drawn across the forehead from the centre of the pit above the eye. (See Fig. 2.)

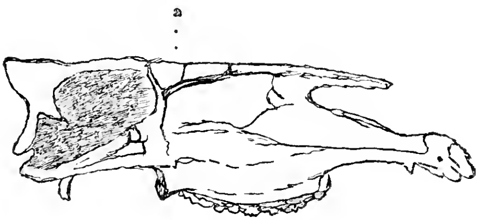


Fig. 1.

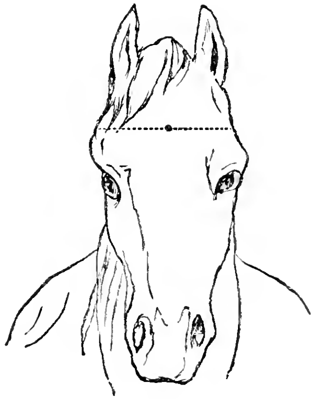


Fig. 2.

One vigorous and well-directed blow will fell the animal, but the blow should be repeated to make destruction sure. Then, drawing back the head, cut across the throat at its upper portion down to the bone so as to open freely all the blood-vessels.

2. *By the Bullet.*—The operator should stand directly in front of the animal, and place the muzzle of the rifle or pistol within a few inches of the skull, aiming at the spot indicated in Fig. 2.

If the pistol is used, one hand may steady the head by grasping the nose-band of the halter, or by taking hold of the forelock. If the rifle is employed, it is better to blindfold the horse or to secure him by the halter. One shot is gen-

erally sufficient, if properly directed in either case; if not, it should be repeated after the animal falls.

In most instances, so great and instantaneous is the shock to the brain from a gunshot wound, that death follows instantly, and therefore opening the blood-vessels is not required.

The pistol used should carry a large bullet, not smaller than a rifle-ball. A shot-gun loaded with buckshot is as effectual at a point-blank range, and may often be more conveniently procured.

3. *By Chloroform.*—Procure a common feed-bag or small sack made of thick cotton-cloth, or of any sufficiently strong material, provided with strings or a strap to fasten over the head, and at the bottom of this place a large sponge or a yard of flannel folded to the size of eight inches square.

The animal having been led to the spot selected, the sponge or flannel is to be saturated with the chloroform and the bag adjusted. If the suffocation and consequent struggling, which at first attend the administration of anæsthetics, are very great, the application of the chloroform may be gradual, the animal being allowed to respire the outward air for a moment, until these effects pass off. As it is by the exclusion of common air, however, that death is produced, the more persistently the administration of the chloroform is kept up, the more speedy will be the desired result.

The dose requisite varies very much according to circumstances. At least sixteen ounces of chloroform should be procured, and it should be freshly applied through a small slit in the bag every few minutes until death ensues, which will be from five to ten or fifteen minutes after the beginning of the operation.

The difficulties attending the administration of chloroform to so large and powerful an animal as the horse, particularly at the hands of the inexperienced, render its use less applicable in producing death than either of the other methods. In cases where sickness and consequent debility have reduced the animal and made him less capable of struggling, it answers a good purpose, but, as a general rule, I do not recommend its use where the normal amount of strength still remains.

If the animal to be killed is to be buried without removing the skin, a pit may be dug, large enough for a grave, one end of which should be so excavated as to make an inclined plane, down which the horse can be led. When in the pit, his head is in a convenient position for the axe or the bullet, and when he drops he falls in his grave, and the labor of removing the body is entirely avoided.

The skull of the ox is thicker and heavier than that of the horse, and the brain still smaller in comparison with the entire head. The frontal bone (Letter a) is composed of two plates, which are separated by bony ridges, forming cells or sinuses. This arrangement gives to the parts great strength, and forms a secure defence against injuries to the brain, which lies beneath (Fig. 3).

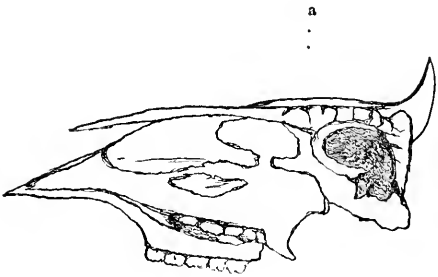


Fig. 3.

Fig. 4.

Cattle are most readily and conveniently destroyed by blows on the head with a heavy axe or hammer, followed by immediate blood-letting. The animal which is to be killed should be secured by means of a rope passed round the horns and fastened to a post, or, if practicable, carried through a ring in a floor and held by an assistant or made fast. The animal being blindfolded, the operator, armed with a heavy axe or hammer, stands to the left and a little in front of it, and aims his blow at a spot in the middle of a line drawn across the forehead about one inch and a half below the base of the horns, or, perhaps better, at the spot where two diagonal lines intersect, drawn from the eyes to the base of the horns (Fig. 4).

In most cases, if the blow is heavy and properly directed, the animal falls instantly; but it is better even then to repeat the blow and to follow it by immediate bleeding. This is accomplished either by drawing back the head, and cutting

deeply across the neck at the upper portion of the windpipe, severing all the blood-vessels, or by plunging a long and sharp-pointed knife into the heart and large blood-vessels at a point corresponding to the upper portion of the brisket, and just above the breast-bone.

Failure to fell the animal at the first blow cannot be attributed to any difference in the anatomical structure of the part, but rather to the fact that the blow was ill-directed, almost invariably too low, that it was not sufficiently powerful, or that both of these faults were combined.

In the slaughtering of calves, it is not a common practice with us, as it is in France and other countries, to render them insensible before bleeding, for fear that the brain may be made less inviting as an article of food by being torn and stained with blood. By using a broad mallet this may be, in a great measure, avoided, and even if these results do follow, they do not in reality alter the quality of the brain for edible purposes. Objections to the humane destruction of an animal on such grounds, are as unreasonable as those which are made to juicy and wholesome red veal, by people who prefer that which has been rendered white, dry and innutritious by repeated bleedings that have reduced the calf before death to a lingering condition of faintness and debility.

The calf should be first stunned by a blow upon the head by a broad mallet or hammer aimed at a spot relatively the same as in the full-grown animal. This is to be followed by immediate bleeding, practised by severing the throat at a point corresponding to the upper portion of the windpipe, using a sharp knife and doing the work thoroughly and at once, so as to open all the arteries and veins of the neck.

Sheep and lambs should be rendered insensible by a blow upon the head, to be followed subsequently by severing the throat, as just advised in the case of calves, or by plunging a sharp-pointed knife through the blood-vessels at either side of the neck between the bones and the windpipe.

The place to be selected for a blow is the centre of a line drawn across the head about two inches above the eyes, the

brain in the sheep occupying a situation posterior to what at first sight would appear to be the natural one.

There is an idea prevalent among farmers, and even among many of those who practise the slaughtering of swine as an avocation, that, if these animals are first rendered insensible by blows upon the head, that it is impossible to empty the blood-vessels.

There is no foundation, however, for any such opinion. Any obstacles to bleeding are due, not to material differences in the anatomical arrangement of the blood-vessels, but solely to the difficulties attending the cutting through of the great mass of fat and flesh which characterizes the necks of swine, in order to reach these vessels,—a reason, certainly, why the animal should be rendered insensible before bleeding, not only on the score of humanity, but also on the score of avoiding the barbarous sights and sounds which so frequently disgrace our towns and villages.

In Europe, generally, and at the present time in our large slaughtering establishments, both in New England and at the West, the swine are always first rendered insensible by being stunned. They should be made insensible by a blow upon the head, directed, not between the eyes, but upon a spot in the middle of a line drawn across the head three to four inches above the eyes. A long, sharp knife should then be thrust deeply through the lower portion of the brisket, at a point just above the breast-bone, severing the large vessels leading from the heart. To facilitate this operation, the head should be drawn back by the hand holding the snout. The point of the knife after it has been thrust in should be swept about and made to cut more extensively in the deep parts than at the surface. This insures the thorough division of the blood-vessels and the most rapid and effectual bleeding of the animal.

Small dogs, cats, and other diminutive animals, particularly if sick or in any way disabled, are humanely destroyed by means of chloroform.

This substance should be administered by pouring from half an ounce to an ounce of it on a sponge or folded flannel, placed within a thick cloth or towel, and applied over the

mouth and nostrils. If the struggling is severe at first, the administration of the chloroform may be made more gradual by removing the sponge or flannel for a moment altogether, and then re-applying it, and, as the animal becomes quiet, it should be kept on closely and constantly, to the entire exclusion of the outward air, adding fresh chloroform from time to time until death occurs. The length of the operation will depend upon the size and condition of the animal, and the persistence with which the administration has been kept up.

As a protection against the struggles of the animal to free itself, the body may be placed in a sack or bag, allowing the head to protrude. Or a blanket may be thrown over the body, by which it may be grasped, and the head suffered to go free for the application of the sponge. Or the animal, together with the saturated sponge, may be placed in a small box and allowed to go quietly to rest.

The young of cats and dogs, when but a few days or hours old, may be humanely destroyed by drowning, if properly executed. This can be best accomplished by placing them in a tight bag containing a stone of sufficient weight to insure speedy sinking.

The quickest method of terminating the existence of a large dog is, undoubtedly, to shoot him. To do this properly and effectually, it is far preferable to use a pistol, and to place the muzzle of it within a few inches of the head, at the side just over and in front of the ear. If the rifle is used the same spot should be aimed at.

It is a common practice to shoot a dog with a pistol, the muzzle of which is directed behind the ear. In this case, unless exactly aimed in the right direction, the ball is likely to glance and pass through the soft parts of the neck, and although death might be the result of the shot, it would neither be so certain nor so instantaneous as if the brain had been pierced.

In the attempt to destroy it, no animal should be merely maimed. For this reason, if a gun or fowling-piece should be used, it should be charged with buckshot, the side of the head aimed at, and sufficiently near to insure speedy death.

The same remarks apply to the destruction of the cat. As this animal is smaller, however, death may be instantly ef-

fected by small shot fired from a gun at the head, sufficiently near to prevent the scattering of the charge.

The remarks which I have already made as regards producing insensibility by a blow upon the brain, may equally apply to poultry. The almost universal method of killing by chopping off the head of a fowl, and allowing the body to flutter about upon the ground, is not an agreeable sight, and has certainly a demoralizing effect upon those who witness it, especially upon the young and those who are not yet callous to such sights. The same may be said also of the practice of opening the blood-vessels in the necks of poultry, and allowing them to bleed to death more or less slowly. Therefore, to produce insensibility, make use of either of the following methods, —

1. Grasp the bird by the legs, place its head upon a block, and strike it a smart, quick blow with a small club, or with some equally efficient weapon, and then immediately sever the head from the body by a sharp cleaver or hatchet. Retain the body in the hand until all fluttering has ceased.

2. Taking the bird up, compress the throat between the thumb and finger for a minute. Retaining the grasp, swing the body round several times, and then remove the head as just described. Here insensibility is produced by suffocation and loss of motion by the twisting of the bones of the neck.

3. A very sharp blow, with a small but heavy stick, behind the neck, at about the second joint from the head, will injure the spinal cord so as to destroy sensation and motion, if properly executed; the head to be afterwards severed from the neck.

4. Hang up the bird by the legs and thrust a long, narrow, sharp-pointed knife, like a pen-knife, into the brain through the back part of the roof of the mouth. Death is instantaneous. To do this considerable dexterity is required.

It has been observed that fish which are instantly killed on being taken from the water are vastly superior, in taste and in solidity, to those which are allowed to die, as is the universal custom with us. And why should this not be the case? Why should we make a distinction in this respect between animals that swim and those that fly or run? No one of us would think of eating beast or bird that had died a natural

death. Various modes of killing fish are practised by different people. The Dutch, for example, destroy life by mak'ng a slight longitudinal incision under the tail, by means of a very sharp instrument.

On the Rhine they kill the salmon by thrusting a steel needle into their heads.

Fish may be easily destroyed by striking them a quick, sharp blow with a small stick, on the back of the head just behind the eyes, or by taking them by the tail and striking the head quickly against any hard substance.

I have made no remarks upon the destruction of animal life by means of deadly poisons, as such agents cannot, with safety, be placed in the hands of the unskilled. Neither have I spoken of the use of various gases as a means of humane destruction, such means not being at the disposal of the people generally.

THE BREEDING AND FEEDING OF STOCK.

Dr. Loring. Mr. Chairman, I have no paper to present to the Board. I have merely some remarks to make with regard to a question, or to questions, with which you are all familiar, which you have discussed over and over again, and upon which every member of this Board has instructed himself by the study of those treatises and books which are devoted to the subject under discussion. I am g'ad for myself that this is the case, gentlemen, for I assure you that I am able, for various reasons, to add but little to the stock of knowledge that is already so familiar to you. One is, because there is but little to add; and the other is, because, after a long lecture last evening and early rising this morning, with a severe influenza, which has been upon me for many days, I am physically unfit to go into any discussion or controversy about any disputed question, however important it may be.

Twelve or thirteen years ago, I prepared with a great deal of care for the Board of Agriculture, a paper upon these subjects, "The Breeding and Feeding of Cattle," and at that time I examined all the best works upon these subjects, and gathered together the experience of all the best practical men whom I could find, both upon the mode by which an animal

could be produced most economically and accurately to the farmer, and the way in which that animal could be reared and fed to a profit. Since that time, I have found but little new. If I were to investigate the matter carefully again, and were to turn to the best scientific books on these subjects that have been provided for use, I should find but little to add with reference either to the breeding or to the feeding of stock; not anything as to the feeding of stock, because that is a matter of experience for the farmer himself; while with regard to the breeding of stock, the problem becomes more intricate, the trouble is greater, and the results are less satisfactory and definite. At that time, almost all the definite law that had been laid down by scientific men or quasi-scientific men, or those men who profess to be scientific, or those men who, drawing abstract deductions from facts, claim to be scientific, upon the business of breeding, was that "*like produces like*." Now, that is not true. The difficulties that surround the breeder of any animal are so intricate, so minute, so insidious, that no general law of that description can be laid down. A horse produces a horse, I grant. The bovine species produce bovine species, I grant; dogs beget dogs, cats beget cats, and pigs, pigs; that I agree to; but beyond that, the rule is in no way applicable to any of those delicate processes which the farmer has to deal with, and those laws which the farmer desires to apply for the production of animals according to specific rules and for specific purposes. Now, why is this? At the close of that brilliant and admirable lecture which we listened to night before last, from him who wields an imperial sway in the realms of science, upon the question of embryology and animal life, you learned that there was a point beyond which even *he* could not go; that his arm was not long enough nor strong enough to reach into and explore those great secrets of reproduction which the Creator has reserved to himself; into that range of nature where man has thus far been compelled to walk by faith and not by sight. You saw him illustrate upon the blackboard the processes by which animal life is carried on, the minute forms which it assumes in the beginning, and how it grows step by step until it reaches maturity, and the various tissues and solid parts are so established that

the animal becomes a living reality. But you must remember that when the question arose in his mind how these matters were to be so regulated, that every farmer could provide himself with good cattle or sheep or horses, up to a specific or definite standard, the whole matter was in the dark; the question was to be left for experiment. There was no law to be laid down; he could not even fix the sex, to begin with; had not even got so far as that. Nor can you establish the precise quality of the animal himself, whatever his ancestors may have been. That is one great difficulty. Science can go no further; having reached the point where there is a veil drawn between it and the workings of Providence, a point beyond which the scientific investigator cannot go. And thus it is, and hence it is, that the law which has been laid down that "like produces like," is subject to so many variations that to the practical farmer, who desires that his like shall be the *best* like, that his cattle shall be standard cattle, that the point to which he aims shall be the highest point, is liable to be utterly discouraged in his efforts.

Now, surrounding circumstances, I think, exercise more influence than science is willing to allow in this matter of breeding. The animal economy is so sensitive, that it is controlled by a thousand outside influences which affect it, even in its embryonic condition. It is so in our own race, it is so in every other race; and the higher the race in the scale of animal existence, the more readily do all those outside and accidental influences work upon the embryo and the animal itself. If you invest your money largely in animals intended to give you a perfect herd, you expect, under the old law that "like produces like," to supply yourself with a herd as good as that with which you commenced your operations. But how many failures lie in every man's path who undertakes this! Every breeder knows that valuable animals are the exception and not the rule. Every breeder of fine cattle knows that the production of a male animal of superior merit is the most difficult thing in the world; and he ought to know, if he is a keen and close observer, that hardly one male animal produced in his flocks and herds, out of a hundred, is fit to reproduce those herds. You know perfectly well how distinguished in the annals of the animal kingdom those

male animals, in every class have been, which have done really good service. One single choice Shorthorn animal commands a fabulous price, because in his family, more males of great value are produced than in any other; the standard of that family is the highest that has yet been arrived at. The best breeder in Vermont once informed me that in that family of sheep which made themselves most distinguished during the production of merinos in that State, he destroyed more than ninety-nine out of a hundred of his ram-lambs as entirely unfit to transmit the qualities he valued so highly.

So it is, my friends, with horses,—like does not produce like in horses. Some horses that have made themselves distinguished for producing animals of great speed, have not been fast horses themselves. Rysdick's Hambletonian is not what is usually considered a first-class trotting-horse, but his "get" are so remarkable that he enjoys an eminent position in the ranks of those animals that are valuable to the stock-breeder. This was also the case with one of Mr. Hammond's rams. He was not a remarkable animal in himself, but his "get" was most valuable. He brought down from his ancestry, and combined, those qualities which made him a most useful animal to all the sheep-breeders of Vermont. So, whether it is failure or success, like does not produce like; but external circumstances, in addition to ancestry, throw this rule out of gear continually, to the eye of the observant and thoughtful.

Now, what do I mean by external circumstances? In the first pla e, the treatment that animals receive from their owners. I do not believe that a violent, unreasonable, cruel, tyrannical master can raise up a good herd of cattle. I do not believe that a man, who, when he enters his stables, treats cattle as if they were mere servants of his to do his bidding, can raise up in those stables a superior class of animals for his own benefit, and the benefit of his neighbors and the agricultural community. I think a calm, steady, high-toned, self-possessed and humane man is the one into whose hands Providence has designed that the great work of reproduction shall be best put; and not into the hands of the cruel and unreasonble, who have no regard for their animals,

and but little knowledge of their wants. No man ever founded a race of animals of great value, who, in many of his attributes, did not challenge your highest respect. I have known many, and among them Mr. Hammond, of Vermont, one of the most ingenious, level-headed, calm and sensible gentlemen in this country in his day, who, by his careful, attention and his good judgment, raised himself to the level of the Bakewells and Collings of the Old World, and was a man who would have done well in any sphere of life. He would have made a good statesman; he would have made a good jurist. If he had sat, with his broad shoulders and his calm countenance, as chief justice upon the supreme bench of the United States, nobody would have raised the question of his fitness for the place. He had great powers of mind and great self-possession. When you were in his presence, you felt that you were in the presence of an invigorating and controlling influence. And so, when he entered his sheep-fold he went there as the father of the flock. They all knew him and all trusted him. When he entered his pens, all was calm and quiet; there was no irritation, no noise, no fear, no disturbance there. Thus it was that Mr. Hammond was the most successful breeder that we have known in our day. So, I have found that all those men who have elevated their herds to a high position have taken pains that all the surroundings of those herds should be admirable. Is there a man in this hall who will question this? Is there a man in this hall who does not believe this theory? If there is, let him recall an instance in which, through his own hard treatment, his herds have deteriorated, his cows have not been up to the standard, his calves have been unequal. That is what I mean by external circumstances.

Then there are other external circumstances. The accident of the day, the month, or the year in which an animal is conceived and perhaps born, may have an effect upon it. A sudden thunder-shower disturbs a cow; so does irregularity of feeding. If you propose to keep your standard high, you must strive for that continually, and keep all surrounding circumstances in accordance with your demands. You can neither, in the treatment of your cattle, nor in their feeding, be negligent or careless, if you expect to arrive at that point

which every good breeder, in this and every other land, aims at.

Now the higher you rise in the scale of animal being, the more thoroughly this law applies. I do not mean to say that all the lower orders of the animal kingdom are equally affected by this law; the variations that take place in them are less. You can breed a dozen pigs, if you are so disposed, and think it is an economical business (which I do not), and they will closely resemble each other; nothing interferes with or disturbs their moral nature. They hold such a position in the scale of being that you may not only produce uniformity under adverse circumstances, but very often perfection. You can reproduce dogs in the same way, especially common dogs, —cur-dogs. But when you go above these classes of animals into the higher range, what diversity you find! For instance, you undertake, as I have done, to establish a family of trotting-horses. Now the trotting-horse is the most thoroughly and accurately organized animal that we have, next to man. In all moral faculties, in physical conformation, in all those powers which make an animal self-reliant and strong, a trotting-horse is superior to all others. And it is on account of the delicate organization of that animal that the external circumstances to which I have alluded affect his reproduction to such a degree that there is no certainty whatever in breeding him. Very few horses, no matter what their speed, have succeeded in producing horses of equal speed. So horses that possessed fine tempers have been so affected by the brutal treatment of their owners, that they have failed to transmit those qualities which made them especially valuable.

Bearing in mind these striking facts, let us now consider more immediately the special business of breeding cattle. The objects which the farmer has in the reproduction of his cattle are two. There are two classes which the farmer requires for his own purposes; and usually, either from necessity or choice, he breeds them according to the circumstances surrounding him. One is a class of cattle for beef, and the other a class of cattle for milk. You may say that the two go together. Partially, and under fortunate circumstances, they do; but the great business of the scientific and accurate

breeder has been to establish a breed of animals intended for beef on the one hand, and a breed of animals intended for milk on the other.

Now let us see how far this theory I have laid down prevails in these two cases. It is found very difficult to secure the uniformity which is desired, even in animals intended for beef. The great beef-producing breeds of cattle are calm and unexcitable; are not easily disturbed. Their brain is comparatively small; they have not a delicate nervous organization. Adverse circumstances do not disturb them materially. They are organized, in all their system, in their nutritive functions and in their nervous organization, for the calm and imperturbable process of converting food into meat; and so it is incumbent upon them to keep themselves in as much repose as possible. They are not easily thrown off their balance; and yet, notwithstanding they are so little controlled by surrounding influences, it is found impossible to secure constant uniformity even in their herds. When you come to another class of cattle, intended for a different purpose, you meet a hundred failures where you do one in the beef-producing animal. The production of milk is the result of delicately constructed organs in the animal economy, easily thrown out of condition. A good dairy-cow has a great deal of brain; she is wide across the top of her head, wide between the eyes, and is a very sensitive animal indeed. A thunder-shower will often reduce her flow of milk; a blow from a whip will often reduce it. She is easily thrown out of condition. Her cerebral organization, and the functions which are devoted to the production of milk, are so delicate that the rule to which I have alluded affects her very sensibly; and the breeder of dairy stock will be continually wondering why it is that he cannot always raise stock as good as that from which he breeds. Some of us know this by sad experience. Here is a good bull, and there a good dairy-cow, and the offspring from the two may be a failure. Why is this? Mainly because all the adverse surrounding circumstances to which I have alluded affect the delicate organization of this class of animals so sensibly that it is impossible even to approach the law that "like produces like" in their reproduction. So it becomes the farmer who is devoted to

the business of raising milch cows for his dairy, to possess his soul in especial peace. He must keep them quiet and in as much repose as possible; he must feed accurately and carefully, or he will not increase his herd as he desires. He must direct the energies of that herd toward the encouragement of the milk-producing organs, and not to the encouragement of the beef-producing organs, or he will utterly fail in the object at which he aims. The breeder of milch cows, therefore, has the most difficult process on his hands; and when you consider that this is almost the only breeding that is of any value to the New England farmer, you can appreciate the importance of observing here the best rules of breeding and feeding.

Now let us consider for one moment what sort of a selection we are to make for the specific purpose towards which we are aiming. Let us turn our attention for a moment to the beef-producing animal. It is not necessary to describe the two sexes, but let us consider the characteristics of these animals as a class. I consider that the head and brain of a beef-producing animal should be comparatively small; that the bones should be comparatively fine; that the expression of the countenance should be somewhat serene and calm. The rib of a beef-producing animal should be round and compact; the shoulders firmly fixed to the body, not projecting in any way like the shoulder of a good dairy-cow or of a good trotting-horse. The parts behind the shoulder should be well filled in, never broken off in any way, because underneath that line lie all the vital organs of the animal, which are so necessary for the preservation of his health. The barrel of a beef-producing animal should be comparatively straight and round. The rump should always be level and long, and that rule, my friends, is applicable to any stock that you see fit to produce on your farm. Breed out and expel all rough and sloping-rumped beasts. I never saw one in my life that was up to the standard; there may be exceptions here and there; one may have a good constitution; but, as a general thing, the animals that have the best constitution, that feed the best, that sell the best when they fall into the hands of the butcher, are those which have level rumps from the hips to the roots of the tail, and certainly they are the most comely. If a man has any

eye for beauty, he never desires to see a mountainous rump in his stable. The legs of a beef-producing animal need not be as sharp and clean as those of a milk-producing animal; they can be rounder, less expressive; the foot can be shorter, the hind-foot especially, without detriment; the brisket should be deep, and all the digestive organs should be packed in a small compass. These I consider to be (adding, always, a lively expression and a good skin) the specific points that should be possessed by the best beef-producing animal. You can see yourself, perfectly well, that they are all easily produced. And if you give such an animal enough to eat, you can easily preserve him in all his perfection.

When you come to the question of milk-producing animals, you want a firm, broad head; a clear, bright, expressive eye; and if the horn is a little large at the base it does no harm. You want the shoulders to be comparatively loose, not compact like the shoulders of a beef-producing, fattening animal, but loosely thrown on, apparently. A good milk-producing cow always has that peculiarity. I have never seen a good cow with a compact shoulder. If a dairy-cow drops a little behind the shoulders, do not let it disturb you. I think a dairy-cow's back and rump should be as level as those of a beef-producing animal; her fore-feet should be broad, firm, and large in proportion to her leg; her leg fine below the knee, and compact and strong above; her hind-feet should be long and projecting. I never saw a good cow that had not that peculiarity. The rib of a dairy-cow, instead of being as round as your finger, and thoroughly barrel-shaped in the formation of the chest, should be flat, as flat as a case-knife, and as thin on the edges. I never saw a round-ribbed cow in my life, no matter how much milk she would give after calving, that would hold out well, or that stood high in the family of good dairy animals. The point of the shoulder of a dairy-cow should be loose and open, so that if you pass your hand over it, you will find your finger dropping into a cup-like cavity. As you pass your hand along the back, the spinal processes should be loose and open; you will feel a roughness from the shoulder along the back, as far as these processes extend; her hind-quarters should be wide. These points to which I have alluded, together with a good skin,

and a good vascular system, with a good milk-vein,—all these put together will make such a cow as every farmer desires for dairy purposes.

Now, how are you going to produce such an animal? You can reproduce beef-producing animals without any trouble, just as you can produce pigs, dogs or cats; not always up to the standard, but you can come pretty near the standard. But if you expect to produce a milk-producing herd with as little care as you can produce a beef-producing herd, you are entirely mistaken. You may take a calf, for instance, when it is dropped, a calf that is intended for a beef-producing animal, and feed it just as you like. You can keep it on the cow, if you wish, six months, and make it weigh as much as a yearling at the end of that time; and feed liberally from this time onward with entire impunity. You have done nothing to throw it out of the condition you desired, but have cultivated and improved upon it. If, however, you expect to get a good dairy-cow by feeding a calf in that fashion you will find yourself entirely mistaken. You cannot raise a good cow by letting the calf run upon the cow six months. You stimulate in that way every function, except the functions for the production of milk. You stimulate all the fat-producing functions, you enlarge and increase the cellular tissue; you increase the size of the bone; you throw that animal, which is intended for the work of making milk, out of that line of life. So you must take a calf that is intended for that purpose, and wean it early. Do not increase its size too rapidly; keep it growing steadily; do not allow it to take on any great mass of fat; convert it into a cow-looking calf as quickly as possible. Do not disturb that animal by undertaking to make a prize calf of it,—to take the first prize when it is a yearling, and never make its appearance again.

These are my opinions with regard to the production of beef-producing and the production of milk-producing animals. One great reason why we fail so often in our production of milk-producing animals is, that we will not be governed by the two laws that I have laid down; in the first place, to keep our cows in a calm, quiescent condition; and, in the next place, to feed a milk-producing animal according to the

work we have laid down for her. I think we should remember not to give a heifer-calf too much milk or too much corn-meal; give it oatmeal, rowen-hay and turnips; keep the calf in a healthy condition; keep it where it is continually growing, but without the least tendency to unnatural and too rapid increase of size.

Now, having secured our herds, we feed them. You can feed beef-producing animals, as I have said, with great liberality. You can feed them steadily, and without fear of disturbing their appropriate functions. But you cannot deal in any such way with animals that are at work in your dairy. I would feed a cow that is devoted to dairy purposes in such a way as to preserve her faculties in all their vigor to a good old age. I don't believe in the maxim, "a short life and a merry one," for a cow. The farmer's adage, "An old cow for milk, and a young hen for eggs," is a good one; and if you want a cow to last for many years you must feed her carefully. You may easily feed her with too much oleaginous matter. Corn-meal is a fortunate possession for us; and it seems to adapt itself pretty well to the animal economy. Oil-cake should generally be avoided; cotton-seed meal should always be avoided. I say this with great confidence, because I have destroyed one good herd of cows by feeding cotton-seed meal. You can get milk in other ways without resorting to this substance. Why, then, cut short the lives of your cows by subjecting them to its inflammatory influences? I would avoid, therefore, all heating and all oleaginous or nitrogenous articles of food; they disturb the functions of the cow; they produce a tendency to take on inflammation of the udder, and they will cut short her usefulness prematurely. I think the best food for a new milch cow, therefore, is that which approaches as near to the natural food she gets in the pasture as possible. When you bring her to the barn, if you have any rowen-hay, give her that; if you have roots, give her half a bushel of roots a day or half a bushel every other day; and in the absence of roots, two quarts of corn-meal.

QUESTION. Won't you tell us about green corn?

DR. LORING. That, sir, is hardly worth considering in the winter time. I am feeding my cows for the purpose of producing as much milk as possible, and retaining their health

and good condition; and for this purpose I feed shorts, corn-meal, three or four times a week Swedish turnips or mangold-wurzels, for the purpose of preserving the tone and health of their stomachs. I am sure that if you pursue this course, you can keep a cow in good condition as long as nature intended she should last.

I have been using recently, as food for my milch cows, large amounts of dried Hungarian grass, and I recommend it highly to all dairymen. I believe I can make more milk with this grass, cut and mixed with corn-meal and shorts, than I can with the best timothy hay, cut and mixed in the same manner; and I am not alone in this belief. And when you remember that you can raise on ordinary land, by sowing the seed of Hungarian grass late in June, from two and a half to three and a half tons of good fodder to the acre, and that this crop can be sown after we have ascertained whether we are going to have a good hay-crop or not, you will see the value of this grass. I have such a high opinion of it, that on my own farm, I have this year and last year raised from seventy-five to one hundred tons of it for the purpose of feeding to my milch cows during the winter season. If, moreover, you sow it at the proper time, you will have a good green crop in the dry months,—a crop which is a great deal better than some other articles which we have been in the habit of feeding. I am happy to know that Mr. Lewis agrees with me in my estimate of this kind of food, both for summer and winter use.

Question. What is your opinion of steamed food?

I am sorry to say that I am still an unbeliever in steamed food. I do not mean to condemn it entirely, but I am satisfied that it is enervating; I think it produces an unhealthy condition of the stomach. I have no doubt it makes an animal dyspeptic. I have no doubt that it produces certain disturbances in the alimentary canal. I am perfectly sure that young cattle, fed upon steamed food, do not thrive as well as those that are fed upon more natural food; and that cattle that have been long fed upon it show the effects in various ways, in the milk-pail, in the stall, and at work. I am aware that steam or hot water applied to corn-stalks has a very beneficial effect upon these as a nutritious article of

food ; but I would just as lief have the hot water as the steam ; and the choice is a mere question of convenience.

Now, with regard to the continual feeding of animals. There have been two discoveries made in Massachusetts that are creditable to the farming community. One was made by the scientific agricultural portion, and one by the practical portion. The discovery made with regard to the flowing of sap is so admirable that every scientific man accepts it, and farmers are all proud of it as one of the results of the Agricultural College. The other discovery was made by a practical farmer in one of the interior towns of this Commonwealth. He learned by experience that a cow cannot eat without cessation, any more than a man can. He laid down the rule for the feeding of animals, that they should have rest, repose, a pause between their meals, just as men should. He discovered that if they were fed a certain length of time in the morning, and a certain length of time in the afternoon, with an interval of repose, it was enough for them. What a valuable discovery that was to all of us ! I wish to say here, that since I have adopted that method myself, I have been entirely satisfied with the results. My cattle are now in such condition that I am satisfied with them, and they appear to be satisfied with themselves. The morning feeding takes from two and a half to three hours. They are then fed with a small quantity of roots in the forenoon, and in the latter part of the afternoon they have their feed of cut hay, shorts, meal, and then a foddering of dry hay ; and that ends it. They are allowed to drink twice a day. They are in a healthy condition. The system economizes hay ; and is one of the best discoveries in the mode of feeding that I have ever known, or applied. We are all under obligations to the gentleman who made it.

Now I have opened this subject for discussion and thrown out some hints with regard to the general management of animals, I beg of you to treat your cattle as well as you know how during their lives, and when you have made up your minds that their career must end, select the most humane mode of slaughtering possible. Feed according to the best rule. Take it for granted that if your standard is high, you will be disappointed in many instances, but also take it for granted, that unless your standard is high, and you observe

the best rules, your whole system of breeding and feeding will entirely fail. I apply these rules, not only to what are called the thoroughbred animals, but I apply them to those animals that have been long bred well and fed well in a good locality, if they are to produce animals like themselves. If a farmer is in such a financial condition that he cannot stock his farm with pure-bred cattle, do not let him despair, but let him remember that by care and attention, and a good selection, he can provide himself with a family of animals which will be serviceable to him, and from which he may receive very certain profits. I can take you to-day to farms in Massachusetts where herds have been kept generation after generation, in obedience to the rules which I have laid down here; where the presence of the breeder has always been gratefully hailed by his cattle; where his animals have always been kept in good condition; where the best rules have been adopted; where the best animals for breeding purposes have always been selected, and the breeds of cattle on those farms are practically just as valuable to the farmer as the best herds that have ever been bred from parentage of recognized purity of blood.

QUESTION. What treatment should you give a cow that has eaten too much corn-meal?

Dr. LORING. I should treat her with a little purgative medicine, if I could get it into her, such as salts and senna. I should unload the cow as quickly as possible, and I suppose that can be done in the way I have suggested. I do not know any other way. There is a curious and sometimes sudden suspension of the action of the stomach, when it has become overloaded with concentrated food, such as the gentleman has referred to. It is pretty hard to tell exactly how to get rid of it. A cow's stomach is a complicated machine. Cows swallow their food in vast masses, which may accumulate when least expected. But I should have no doubt that purgatives and injections would usually remove the difficulty to which the gentleman alludes.

QUESTION. Would you give her water?

Dr. LORING. I don't think water would hurt her. I think it is the compacting of the meal, not the swelling of the meal, that causes the trouble; the mucous secretions of a cow's stomach are so profuse that the mass of meal will be

wet through, whether she drinks or not. I should not, however, hesitate to give her water.

I have been requested by Mr. Shapleigh to state that this is a picture which has been sent here out of respect for the Board of Agriculture by the Rev. Mr. Murray (referring to a portrait of a horse hung upon the wall at the rear of the platform). It is a picture of one of his favorite horses, and as a member of this Board I am under many obligations to Mr. Murray for paying us this attention. He is deeply interested in this branch of agriculture, not only to establish certain laws by which good horses can be bred, but also to cultivate the human mind to the best knowledge of those laws. He has attempted to introduce humanity into horse-breeding, horse-shoeing, horse-feeding and horse-driving, and in this I warmly sympathize with him.

Mr. BELA J. STONE, of Westborough. You all know that I am not in the habit of public speaking, and it is almost impossible for me to attempt to say anything at this time. I have listened to the very entertaining lecture of Dr. Loring, and I feel that it is hardly worth while for me to give my views in regard to breeding and feeding stock. But I will say, that some twelve or fourteen years ago I began to breed thoroughbred stock, and I must say, that from that time I have had a great love for cattle and for breeding, and trying experiments. It has given me great pleasure and satisfaction, and I have attempted to inform myself, by my own experiments, in regard to the best method of breeding and feeding stock. It has been my whole business.

In the first place, in regard to feeding. I have tried every way, and have found that regularity in feeding is the first great object, and I have practised the system for years of feeding regularly and giving the cattle rest. But I have always had a great desire to find some way of preparing my coarse fodder so as to make it more palatable to my cattle. I have watched Mr. Birnie's operations at Springfield for years, and have been at his place time and again, and investigated his method, and I have felt satisfied that he was keeping fifty head of cattle on less fodder than I was keeping twenty-five head upon, and I made up my mind that I would try the experiment. I steamed my food the last part of

last winter, and I am pursuing the same course now, and I am well satisfied with the results at present, although some of my friends have told me that I should soon abandon it, that there are those all around us who have tried it thoroughly and abandoned it, and I should do the same; but I cannot now say when that time will come, for the longer I do it the better I like it and appreciate it. I remember that in conversation with Mr. Birnie, in regard to it, he informed me that he had been steaming the food for his cattle nine years, and thought more and more of it every year. Such an opinion, from one who had tried the experiment, strengthened my faith, and last season I put in a tubular boiler of two-horse power, made a large box, mixed my food as well as I could,—as I should to feed good feed—wet it thoroughly with water, put it into my box, attached it to the pipe from the boiler by a coupling, and steamed and cooked it thoroughly all day, with as much pressure of steam as the box would bear. I found, by weighing my coarse fodder, straw and corn-fodder, and weighing my meal, that I could furnish the raw material for forty head of cattle at a cost of less than four dollars a day, or about ten cents a head. And I can say this: that I never saw the cattle so perfectly satisfied with what they ate, so contented, so ready to be shown at any time; they are as ready to have a man come to the barn within an hour or half an hour after they are fed, as at any time; they are perfectly contented, and thrive better than they did before, when I undertook to feed them on dry hay and dry meal. I began this season as early as the middle of November to steam my food, and I am satisfied that it is a great saving; I am satisfied that my cows give more milk, that young cattle thrive better, and I am satisfied that they are as healthy, and I do not see that it is any more liable to hurt them than it is to hurt us to have our food cooked nicely. It makes the coarse fodder soft, it makes it very palatable, and they like it, and it satisfies them at a less expense than I can do it in any other way.

I have been very much pleased in looking over the fine stock and splendid arrangements we have seen yesterday and to-day, but it is manifest that many of us could not go to that expense. But I observed one thing this morning, in the

method of steaming the food, which I should criticise. I did not see any way in which the food could be softened in those iron tanks. I have a box that I made, with a false bottom, with slats four inches wide and half an inch apart; I put my food, after mixing it in another box, into that box; the water settles to the bottom, perhaps two or two and a half inches deep; I let the steam directly into that water, under those slats, which boils the water, and very soon the steam escapes freely and evenly from the bottom to the top. You can boil that water and it will not break the box. I intend to keep a pressure of forty or fifty pounds, until I warm the food up. It is very much cheaper, to say nothing about the first cost any way, if it had to be renewed every year, but I am using the same one that I did last year. It cooks the food very easily and softens it, and when I feed my cattle it seems softened to pulp. I do not claim that there is any real goodness in steam, but I think it prepares the food in such a manner that it aids digestion, and it helps supply the animal heat which a large amount of our food assists in supplying, and a smaller quantity, therefore, satisfies the animal. I know that my cattle are not so large as those we have seen here; they are a smaller breed, being Ayrshires and milch cows, and growing heifers. I saw an account of the expense of feeding those animals which we saw this morning, which is a very small sum considering the size of the animals and the condition they are in; but I think that for fifteen or sixteen cents a day you can feed good milch cows, that are giving a full flow of milk every day. And in order to make milk, at the price that we have to make milk now to send to Boston market, we have got to devise some means whereby we can produce that milk cheaply, to make anything.

This question of breeding and feeding is a very interesting one to me, and one of great importance. I did not expect to be called upon to say anything before this body, but I hoped to hear the views of some men who are better posted, and have had more experience than I have, and I thought I should have a good opportunity to ask some questions. I would like now to hear the experience of those who have fed in various ways, that we may arrive at some conclusion as to the best way.

In regard to the breeding of cattle, I agree with Dr. Loring, that a man must be kind and humane to them. I believe there is a great deal in that in breeding. I have never thought so much of it as I have this morning, but I always make pets of my cattle; they are always kind and gentle, and seemingly like to see me, as Mr. Hammond's stock liked to see him; and when a man can attend to them, that is one great source of pleasure, if not of profit.

QUESTION. I wish to ask Mr. Stone if he is any stronger in the advocacy of steaming food for cows than Dr. Loring was ten years ago? Dr. Loring has abandoned it entirely, as he has said here to-day, and I should like to ask Mr. Stone if he has any reason to believe that, ten years hence, he will be as much in favor of it as he is to-day?

MR. STONE. I cannot answer for Dr. Loring. I do not know how much he was in favor of it ten years ago. But I have had this on my mind for more than ten years, although I have not had an opportunity to try the experiment. I was told last year that I should like it very well the first year, the second year not quite so well, and the third year, I should give it up. I cannot tell how that may be. But I will say this: if I should be engaged in other business, and be obliged to leave the care of my animals to hired men, who do not understand it, or take any interest in it, I do not know but the safest way would be to feed them on dry hay, and have them come out as poor as they may in the spring. But if a man wants to try the experiment, and satisfy himself which is the best and most economical way of feeding, I advise him to try it. It will cost but little. My whole arrangement cost me only $250. I am now moving my boiler right under the L that runs from my barn, where I can run my steam-box within four feet of the boiler, because I can save fuel. Twenty pounds of steam will then answer my purpose as well as forty did under the former arrangement. One or two hods of coal a day is all that will be necessary. The expense is very little. As nearly as I can estimate, with my stable full, which holds forty, I can keep my cattle in good condition (with one man to card and clean them, in a barn arranged as mine is, on one floor), for fifteen cents each a day, including the labor, and you can judge whether that is a high cost for taking care of my stock of cattle.

Mr. Hubbard. Have you practised feeding cotton-seed meal or oil-meal?

Mr. Stone. I have fed considerable cotton-seed meal, first and last. I have thought that if the manure from cotton-seed meal was worth so much more than other manure as it is said to be, it would pay to feed it. If we exercise proper judgment in the matter, there is no more dfficiulty from cattle eating cotton-seed meal than there is from our eating hearty food.

Mr. Hubbard. How many times a day do you feed?

Mr. Stone. Twice a day. Last winter, about eight o'clock in the morning and four in the afternoon. I steam enough in this box for all day. I detach the coupling, draw the box in front of my cattle, take off the cover, and feed them. This winter I have begun at six o'clock in the morning, and I give them a trifle of dry hay at noon, and water them. They all feed alike. I give them a small forkful in the morning; they are then carded, and then they lie down.

It was suggested this morning, that we cannot cook food without a high pressure of steam. My experience is, that a high pressure is not required after the water boils. I use some eighteen or twenty pails of water, which settles to the bottom of the box, and when we feed the last time in the morning, there is a quantity of hay-tea in the box, which I draw out. If I have any milch cows that I want to feed a little extra, I mix a couple of quarts of shorts with that hay-tea, and let them have it extra. Calves like it and cows like it. It is a nice way to feed meal.

The question has been asked by several gentlemen this morning, if nice, sweet, early-cut hay can be improved. I can say this: I do not know, if I had no coarse fodder, that I should put in a boiler to steam hay of that character; but I should like a boiler to boil water in which to mix my shorts and meal, and let the cows have it in a liquid form. I think that hay can be mixed with the coarse fodder that is raised on a farm and steamed to advantage. It sweetens the whole mass.

Mr. Hubbard. Do you think it adds anything to the nutritive qualities of the hay to cut it?

Mr. Stone. I cannot see why it should. It makes it more convenient for mixing and steaming.

Mr. Hubbard. I understood you to say that with half the quantity you kept your cattle in good condition.

Mr. Stone. I attribute it to this: that preparing the food in this way aids digestion. That is my theory. It aids digestion, helps supply animal heat, and gives a better return for the food consumed. It may not be so, but that is my theory.

Mr. Hubbard. I think there were two or three very important points brought out in the address of Dr. Loring. One of the most important was the treatment of cows. I believe that one of the most desirable things in the management of dairy-cows is, that they be treated well and gently. If you speak to a cow sharply when milking her, or hit her a slap, she is a nervous animal, and you see the influence upon her at once. These things occur, and they injure the flow of the milk more than anything else you can do.

I agree, also, with the suggestion that has been made, that cows should be fed regularly. It is just as important to them as it is to us to have our meals regularly. Whatever the food is they should be fed at regular hours, instead of having a quantity of hay given them every time the man went into the barn. Under that system, they were never quiet.

In regard to feeding cotton-seed meal and oil-meal, I would state that I know of one dairy of over fifty cows, where they have fed these things, and have got good results for a short time; but my object in asking the question was to ascertain whether it was profitable to feed these oily meals at all. It seems to me that they can be fed with perfect safety, if they are fed in small quantities; but I am satisfied, from the testimony of those whom I have known and the dairies I have seen, that when these substances are fed in large quantities, although the flow of milk is largely increased for a short time, the cows have to be changed; they cannot be kept more than one or two years.

Mr. Everett. I have been requested to make a few suggestions on one or two points that have been discussed in Dr. Loring's eloquent address.

He made a distinction between animals raised for the dairy and animals raised for beef. I do not believe in that distinc-

tion. It may take a long period of time for the breeders of Shorthorns and Herefords to produce cows that are just as sure to produce animals of good milking qualities as some of the other breeds, but Mr. Page, of Fitchburg, claims that he has one or two pure-bloods that are very large milkers, and the Winslows, of Putney, Vt., claim to have one or two cows that will yield as large quantities of milk as any other breed, native, mixed or pure. The question with me is, cannot the two qualities be combined, in the race of Shorthorns and Herefords, for those are the two great races that are valuable for beef. That is my specialty in farming; I fatten cattle in the old town of Princeton; and when I looked at those animals of Mr. Whitman this morning, I naturally looked at them from my stand-point, as a beef-producer. How admirably those cows looked to the man who delights in roast beef and beef-steak! It made my mouth water to look at them. But if I looked at their milking qualities, it started water from my eyes—a very different sensation from that of water in the mouth. They are cows that are extremely valuable; they would sell for hundreds of dollars, perhaps well on towards the thousands, but they have really no well developed milking qualities; bags small, teats small; there is no place for milk apparently. Now, as I have said, Mr. Page has one, the Winslows have two or three that they claim are very excellent milkers, and that those cows are just as good to produce steers and heifers for beef as any of those that we looked at this morning.

I know it is the opinion of some of our friends connected with this Board, that good beef qualities and good milking qualities cannot be united in the same breed; but take this view of the question. It took Bakewell and Colling, Booth, Mason and Bates, in England, and many more in this country, a great many years to develop the breeds to which they have paid particular attention. It is about one hundred and twenty years since Bakewell commenced to improve the race of cattle in England, and in that one hundred and twenty years, from the coarse, great-boned cattle upon which he commenced, what perfect symmetry of form, and size and power to take on fat have been acquired in the Shorthorns and Herefords! I mention these races especially, be-

cause they are the best beef-cattle of any we have. But the English breeders did not, neither have any of the breeders in this country, so far as I know, even up to the present time, attempted to develop their milking qualities, though I am told by a friend from the college at Amherst, that they are designing to make an effort to accomplish this most desirable result. I am sure that the breeder of cattle who will combine the two together (it may take generations to do it), and get in the same breed first-rate qualities for milk and butter, and also for beef, will be a great benefactor of his race. I assume that this is possible, from the fact that some of those animals that have been raised purely for beef have come to be, hap-hazard, excellent for milk, as in the cases to which I have alluded. I was on the committee at the Worcester show last fall, and saw a grade cow—a native Durham, I think—that had given twenty-six quarts of milk a day for months. But very few pure-bloods have ever come up to that.

I do not believe, as I have said, that it is impossible to make this change, and I am told by the head of the agricultural department at the Amherst college, who has witnessed stock-raising in England to some considerable extent, and also in this country, that he does not believe it is impossible, and that they are endeavoring to produce this great desideratum, the bringing together of first-rate butter and milk qualities with first-rate beef qualities. When you have accomplished that, you have got a perfect animal. I believe it will be done in the next fifty years, and I want to see measures inaugurated to do it. Talk about the impossibility of doing it! Why, if it has been done in a hap-hazard way, can it not be done on system, and a race of cows produced that shall be just as certain to produce their like for milk and butter as they are for beef?

Mr. Slade, of Somerset. I understand that Dr. Wakefield, a member of the Board, has an interesting paper which it would be proper to have read at this stage of the discussion. I move that he be invited to present it.

The motion was carried, when Dr. Wakefield presented the following,—

DESCRIPTION, MANAGEMENT, STOCK, CROPS, PRODUCTS, EXPENSES AND PROFITS OF THE FARM OF THE STATE PRIMARY SCHOOL FOR THE YEAR ENDING OCTOBER 1st, 1873.

DESCRIPTION.

The farm of the State Primary School is situated in the northerly part of the town of Monson and in the easterly part of the county of Hampden. It contains two hundred and thirty acres of land, which is drained by the Quaboag and its tributaries. This river unites with the Ware and Swift rivers at Three Rivers Village, in the town of Palmer, and forms the Chicopee River. The north-east part of the farm extends to the Quaboag River, but the main part is situated in the valley extending southerly from the depot in Palmer to the village in Monson. This valley is flanked with hills on either side, east and west, to the height of from two to three hundred feet. The highest point of this valley is about equidistant from Palmer and Monson, whence the land falls to the south and to the north. The land of this farm lies on the northerly slope. A brook, large enough in the spring to carry a saw-mill, runs through the centre of the farm in a northerly direction, while a smaller one comes tumbling down from the hills on the west at right angles with the larger one, affording the farm a bountiful supply of pure water. The rock formation underlying the farm is granitic, which crops out on the surface on the southerly slope of this valley, and is worked extensively by Wm. N. Flynt & Co., specimens of which may be seen in the Agawam Bank building and the building for the offices of the Boston and Albany Railroad Corporation in Springfield. When in a state of nature it was covered with a bountiful crop of huge bowlders. The soil is a dark mould about ten inches deep, with a subsoil of lightish clayey loam of about twenty inches in depth, when it comes to a blue fine sand as a hard-pan that bids defiance to leaching in all its forms. The soil on the opposite sides of the hills flanking this valley is much lighter than on the sides descending into this valley. There is a marked difference between this valley and any land in this immediate region. It is full of springs, uneven in surface, hard to sub-

due, requires a large amount of teaming to carry it on; but it will carry out a better crop than any land with which I am conversant—certainly it will give better returns for any investments made upon it than any land I ever worked upon. Some twenty-five acres are covered with a growth of wood, a little over twenty were under the plough this year, eighty-five were under the scythe and one hundred in pasturage.

The mowing and tillage lands in the valley and on the hill-sides are divided into lots of five, seven, ten and twenty acres each, and surrounded by stone walls, while the pastures extend further back on the hills, affording an eastern and western declivity and an early growth of feed on the one side and a later one on the other side.

MANAGEMENT.

All the products of the farm are consumed on the premises. About seventy tons of flour, fifty tons of grain and feed and twenty tons of straw are purchased and used on the farm. From three to four tons of bones are saved, ground and manufactured into phosphates on the premises.

To make farming profitable this rule must be rigidly adhered to, "Improve rather than exhaust your soil," "Return more than you take from your land."

All the manure that can be manufactured from all sources, from the time of planting till the cattle are housed in November, is devoted to top-dressing the grass-lands. The stables, cow-yards and hog-stys are supplied with loam and muck as absorbents of the urine, which also furnish top-dressing for the grass-land. The washing from the laundry and the water-closets are all turned on the mowings, while the privies are daily supplied with coal-ashes or loam in sufficient quantities to absorb the urine and render them nearly odorless.

The droppings from the cattle, horses and hogs during the winter are hauled directly to the fields where they are to be used the next season, to be composted with the soil itself.

The pastures have a yearly dressing of one hundred pounds of gypsum to the acre, and all mowings not otherwise top-dressed are served in the same manner. In this way our pastures improve rather than deteriorate; bushes and mosses die out, while white-clover comes in. No fertilizer pays so well on this land as gypsum.

This system of management involves a large amount of labor, but it saves buying commercial fertilizers, tells on the crops and is a paying investment.

STOCK.

The stock of the farm consists of four horses, two colts, eight oxen, thirty-four cows, six two-year-olds, five yearlings, nine calves, one bull, or sixty-three head of horned cattle, eight sheep, twenty-six hogs, and fifty-one pigs. The majority of the cows are Ayrshire or Ayrshire grades, yet there are some grade Durhams and Jerseys. The young stock is all pure Ayrshire or grade Ayrshire, one-half, three-fourths or seven-eighths.

The herd of cows was not as large as that of last year, nor did they do as well. Whole amount of milk produced, 92 tons. The average yield of milk per cow for the whole herd of 36, was 2,325 quarts. Average yield of the twelve best cows, was 2,817 quarts. The cows are always milked in the barn at five o'clock, morning and evening, and the milk of each cow is weighed at each milking and the amount given is reported at the office each day.

The cows from the time they are taken from the pasture in the autumn are fed twice a day with cut hay mixed with about four quarts of wheat-bran for each cow; the balance of feed is dry hay, with from twelve quarts to a half bushel of roots for each cow per day. The cows are watered twice a day, and in pleasant weather are permitted to bask in the sun in the middle of the day.

While at pasture in the summer the cows each day have a foddering of cut hay mixed with two quarts of wheat-bran on coming to the barn in the afternoon, and when feed in the pastures grows short they are fed with green corn-fodder, cut daily, and when this fails, cabbage-leaves, root-tops, rowen and bran tides them over the hardest season of the year, for those which must make about the same quantity of milk that is required when in full flush of feed. As the weather grows colder and the autumnal storms come on, one thing must be guarded against—your flow of milk must not be greatly diminished or it cannot be regained again during the cold season.

PRODUCTS.

On the first day of October we are obliged to make a report to the governor and council of the condition of the institution at that time. Some disinterested person makes an appraisal of everything connected with the establishment, and among other things of the products of the farm. He gives the appraisal of the products on hand October 1st, and the amount consumed is also estimated at the same prices.

The whole amount of products of the farm for the year ending October 1st, 1873, is,		$15,581 57
The veal, beef, pork, potatoes, milk, etc., for consumption by the family and sales are,	$8,257 87	
The manure for keeping the land in heart, the hay and root-crops for wintering the stock and fattening the pork is,	7,323 70	
Making,		$15,581 57

2,018 bushels potatoes, 50c.	$1,009 00	
575 pounds veal, 12c.	69 00	
5,333 pounds beef, 9c.	479 97	
9,274 pounds pork, 8c.	741 92	
60 bushels onions,	60 00	
4 tons rye straw, $20,	80 00	
75 bushels rye,	67 50	
1½ tons winter squash,	60 00	
Roots for table,	200 00	
500 heads cabbages,	40 00	
86 bushels sweet corn,	32 25	
10 barrels apples,	24 00	
92 tons milk, 20c. per gallon,	4,298 00	
6,000 feet lumber, 19c.	114 00	
41 cords wood,	205 00	
10 calves raised,	221 50	
Colts and heifers,	215 00	
Wool and lambs,	18 00	
Calfskins,	11 85	
Garden sauce,	104 88	
Amount carried forward,		$8,257 87

Amount brought forward, ...			$8,257 87
$138\frac{1}{2}$ tons hay, . .	$3,345 50		
$31\frac{1}{2}$ tons rowen, .	787 50		
$6\frac{1}{2}$ tons millet, .	130 00		
2 tons corn-fodder,	20 00		
55 tons green corn-fodder, . .	120 00		
		$4,403 00	
75 bush. parsnips,	$45 00		
600 bush. ruta-bagas,	270 00		
1,116 bush. carrots, .	524 70		
1,150 bush. mangolds,	460 00		
500 bush. E. turnips,	125 00		
160 bush. sug. beets,	96 00		
	$1,520 70		
Deduct for family use,	200 00		
		1,320 70	
400 cords manure, at $4, . .		1,600 00	
			7,323 70
Whole products of farm, ...			$15,581 57

Both crops of hay averaged a little over two tons to the acre.

I entered a field of carrots containing one acre and a half for premium from the East Hampden Agricultural Society. All who viewed the field said they were the most even and handsome they had ever seen. In 1871, this land was planted with potatoes, and each hill had a shovelful of barn-yard manure. In 1872, it was in beets and a part in cabbage and had the same culture as it had this year. In 1873, the land was ploughed twice and harrowed three times. Seven cords of barn-yard manure to the acre were ploughed in and four hundred pounds of ground bone to the acre were sown broadcast before the land was harrowed. The seed was sown May 22, and the roots harvested November 6. Amount of roots, 1,166 bushels—more than 775 bushels to the acre and rising 21 tons to the acre.

EXPENSES.

The land is valued at	$18,778 69
The stock is valued at	6,032 00
The farm buildings are valued at	5,590 00
The tools are valued at	1,100 00
Making,	$31,500 69
The interest on this is	$1,890 00
Grain purchased,	1,591 00
Labor,	2,364 00
Board of men,	700 00
Fertilizers purchased,	272 00
Pasturage,	150 00
Making,	$6,968 00

Deduct this from the amount raised for consumption by the establishment and you have a margin of profits of $1,289.87, besides $7,323.70, to wit: manure for improvement of the farm and raising crops, and hay for the cows that produce the milk and teams that do the work.

In 1872 the products of the farm exceeded those of this year by $961.10. The hay and potato crops were larger, the milk product was larger, and the grain bills were larger, while the root-crop was smaller and the bills for pasturage and fertilizers were smaller. The products for consumption by the family were larger, and as the expenses of carrying on the farm varied but little from this year, the margin of profit was a little broader.

In addition, the farm has kept two horses for the use of the institution alone. The teams of the farm have drawn from the depot five hundred tons of coal, sixty-five tons of flour, all the salt, sugar, molasses, dry-goods and groceries used by the establishment.

For the last six years the teams of the farm have done all the team work and the farm hands a greater part of the labor expended in clearing land of stones and bushes, building stone walls, laying culverts and drains, reconstructing bridges carried away by freshets, constructing dams for

water-works and an ice-pond, grading yards, and making roads, putting in foundations for sheds, hog-house, swill-house, tool-house, chair-shop, boiler-house and chimney, hauling bricks for the same, raising the old barn and grading around the same, etc., etc., without the farm's receiving one dollar of credit for any of these improvements.

I have prepared this statement and submit it for your consideration for a twofold purpose: *first*, to call the attention of the State Board of Agriculture and the farmers of Massachusetts to this farm and school; to awaken a deeper interest in the management of this farm, its crops, and its stock, and to let them know what is being done in the way of farming at this primary agricultural college of Massachusetts, which is sending out yearly over a hundred boys, most of whom will become tillers of the soil and laborers on the farm, and shortly will be the farmers of the coming generation; and *second*, to meet, with figures that will not lie, the cavillings and carpings of those who are constantly asserting that farming don't pay, that no institution can manage a farm to profit, that milk can be bought cheaper than it can be made, and answer the thousand and one foolish positions taken by those who make most positive assertions about what they know little or nothing.

Mr. Root, of Barre. I have listened with a great deal of gratification to the very clear and accurate statement which the worthy superintendent of the Monson school has given us. I feel that he has done a service to the farmers of Massachusetts in making this clear and lucid statement of the management of that institution. We as farmers desire to know more of the general mode of procedure at our public institutions, and more of the general expenditure which is incurred at those institutions. I feel grateful to the gentleman for making the statements which he has made to-day.

Afternoon Session.

The meeting was called to order at two o'clock, Hon. J. F. C. Hyde in the chair.

The subject for discussion was "Fruit-Culture and Market-Gardening," and was opened by a lecture on

GRAPE-CULTURE IN MASSACHUSETTS,

By Dr. Jabez Fisher, of Fitchburg.

At the request of your committee of arrangements, I have consented to open the meeting this afternoon with some remarks upon grape-culture. I do not propose to go over the whole ground, because it would take too much time, but only to touch upon the salient points; and more especially upon some points in which I may present something new, or something different from the opinions entertained by other cultivators. At the same time, I give you permission to ask any question, at any time; it will not disturb me; only be sure to put your questions in such a way that they will be pat to the point under consideration, or else bottle them up until I get through, and then put them all at once.

A very important consideration, and one which seems to be lost sight of by most cultivators, is this: that we in Massachusetts are situated away up at the northern limit of successful grape-culture. We are almost too far north to succeed, and in many parts of the State it is impossible to succeed. There are a very few favored spots, a little north of Massachusetts, in which fair success may be had; but the most northerly isothermal line of success in grape-culture runs just about through the spot where we stand, in Fitchburg. In the Connecticut Valley, it runs up to a higher latitude; in the Green Mountain range it comes down below this latitude. We have this to contend against as our first enemy, and we must use all the means in our power to overcome this difficulty, which results from the fact of our being at the extreme northern limit of successful grape-culture. You may say, "Why not go South, where we should not have this difficulty to contend with?" Well, we were born in Massachusetts, and we propose to stay here. That is the first reason. Secondly, if I were to select a place for the successful cultivation of the grape, I should choose a location right here, not because I can get better success here in the way of cultivation, but because it requires more intelligence, more brains

to succeed here than it does somewhere else. A man who has no intelligence and no brains should go where success comes of itself; but if he has those qualities by which he can overcome obstacles, let him stay where there are obstacles to be overcome. There is an advantage in being so far north, in the fact that we are nearer the markets. We have a better market than they have at the South, and the market for grapes is somewhat limited by the difficulties of transportation. It is difficult to get them to market in their perfection; hence they should be grown near the market, and not at a great distance.

Now, to begin with, I propose, in a practical way, to tell you how I should attempt to raise grapes, in the light of my present experience. I do not say that I should do the same thing a year hence, but as far as I know now, I will give you an idea of the way I should go to work. The first thing is choice of a location for the vineyard. We are necessarily limited to this latitude, but we want a location that will be as far south as possible. How shall we get it? We must select a warm spot, to begin with. It will not do to go on Mt. Wachusett, it is too cold; it is virtually two or three hundred miles north; it is out of the range of successful cultivation. We want to get as far south as we can, and still keep in Massachusetts. To do it, we must take some land that turns towards the sun, receiving its rays more nearly perpendicular; that is, in fact, practically further south. Hence we want land sloping to the south. But then there is a limit to that slope. It may be too steep, when it will cost too much to cultivate it; we have to terrace it, or something of that kind, and the land washes badly. But we want as much of a southern slope as we can get without sacrificing too much. In that way, we get south fifty or a hundred miles. That is one way to overcome the difficulty of being too far north.

Then, again, the particular lay of the land has considerable to do with the ripening of the grape. If we locate our vineyard in the bottom of a valley, where it is very hot in the day-time, where, perhaps, the thermometer would show the highest average range of temperature during the season, we are liable to have severe frosts early in the autumn, which, although they may not spoil the grape, will injure the foliage,

and very much retard the ripening. That is to be avoided. The tops of hills are also to be avoided; because they are of lower temperature,—they are further north. The very best place is on a southern slope, about two-thirds of the way up, situated on some high ground, but still sheltered by the tops of the hills. That seems to me to be the most favorable location we can get. The grape is a plant that likes heat above all things. It does not care for much moisture, but it wants plenty of heat and sunlight.

Then, in the choice of soil, the same thing is to be considered. We want to get as far south as we can in that respect. Hence, we do not want a strong, clayey, deep loam; we want something that is a little lighter, and that is warm. We want a soil that will take and retain the rays of the sun as much and as long as possible. We want to raise the temperature of our climate as much as we can. Hence we would choose a piece of light soil. But there comes in this objection: a very light soil will not produce the finest grapes for market, although they may ripen them earlier than stronger soil. We are aiming at the very finest results. What I mean by success is, that we shall get a first-class product, that shall bring the highest price, or give the most satisfaction if we eat it ourselves. If we go further north, then we must choose a lighter soil and thus give increased heat and shorten the time of ripening. If we go further south, we may choose a stronger soil as the season is longer. The further north we get, the lighter the soil must be on account entirely of this matter of heat. But right here I should choose neither the strongest nor the lightest soil. I should prefer a moderately strong, friable loam, if I could get it, on gravelly bottom; but such lands are very uncommon. We want land that is naturally drained, because a piece of land naturally drained is drier and better than a piece of land that has to be artificially drained, the soil being of the same quality. If it is not of the requisite character, so far as drainage is concerned, it must be artificially drained. But I have no time to speak of the mode of draining, or anything of that kind.

Having selected our location and our soil, we are next to consider what is to be done towards preparing the land and

setting out the vines. In preparing the land, but very little of that kind of labor is required that used to be talked about a great deal in the books some years ago. We used to be told that we must trench our soil two or three feet deep, if we would grow grapes successfully. I think that idea has been exploded, as far as we are concerned. If you go south five hundred or a thousand miles, there it is necessary to trench; there you want to get a more permanent moisture. It is a different kind of business there from what it is here. Here we want to get all the effect of the sunshine that we can; we want to get all the heat and retain it all. Hence, the original preparation here should be very shallow, and the after-cultivation should be of the same character. We want to encourage the formation of roots near the surface all the time, and never to induce them to go deeply, out of the influence of the sunshine. The preparation, therefore, should be simply shallow ploughing. Perhaps "shallow" is not sufficiently definite. Some people call three inches "shallow," and others call seven inches "shallow." I would not plough the ground for grapes more than seven or eight inches;—that I call shallow ploughing. I think there is another advantage in not going below that. My investigations into the character of the grape have satisfied me that the roots are not, generally, more than five or six inches deep. They are spread out in the ground, a perfect network, at about that depth, with only an occasional straggling root growing down deeper. The grape, as I have said, is a plant which loves heat, and it very naturally keeps its roots near the surface, where they get the heat.

It makes but very little difference in what condition the ground is before you begin. There is no coating of manure that can be put upon the soil that equals the sward; I do not know of anything that compares with it. It is not very comfortable to work upon the first year, or until it has rotted, but I would never rot it by raising a crop; that uses up half of it. I would rather the nutriment contained in the sod would go to my grapes that I am planting than to something else beforehand.

It used to be a theory among grape-growers I believe, some years ago, and some of them hold to it still, that the

soil for grapes should be very poor. I entertained that fallacy at one time. It so happened that I was working on land that was in rather fine condition, and there I got all the growth I wanted; in fact, I got sometimes more than I wanted; and of course I used to talk about having the soil for grapes rather poor. I have come to alter my mind. I find that grapes, little as they exhaust the soil, still do exhaust it, and it is necessary to feed them in order to keep up their productiveness. But there is a difference in the character of the nutriment applied. We do not want to feed grape-vines largely with ammoniacal manures. They cause an exuberant growth of foliage and wood; they do not bring us fruit. We want another class of fertilizers. Hence barn-yard manures are not the things to apply to grapes, and we do not want land that is full of anything of the kind. Whatever there is in the land should be rotted, unless it is sward, which does not have the influence that barn-yard manures do in their green state.

Having prepared the ground by simply mellowing the surface in any way, whether it has been under cultivation or whether it was in sward, we are prepared to grow and plant the vineyard. The first thing is, to select our vines. The best way is to go to a man who knows how to grow vines, and buy them from him. I believe in specialties in almost everything. If a man wants to grow grapes, he should grow grapes; if he wants to make commercial fertilizers, he should make commercial fertilizers, supposing he is honest. The man who grows grape-vines as his business will grow better vines than a man who does not make that his business, but who grows only a few. It is a very easy matter to grow grape-vines; anybody can do it. But the trouble is this: if an amateur plants a lot of cuttings and gets a thousand vines, that he wants to set for fruiting, he will be sure to use a good many that are worthless, and should be thrown away. If he goes and buys them and pays his money for them, he will buy the best, or should buy only the best. Therefore, I would recommend you to purchase the vines of some experienced grape-grower, rather than to undertake to grow them yourselves. Besides that, you gain one year's growth which is virtually one year's crop of fruit.

There is some difference in the quality of vines. I suppose I shall tread upon the toes of some nursery-men here; I expect to. You find advertised in the catalogues, one-year-old vines at a certain price; two-year-old vines at about double the price; three-year-old vines, very large and ready for bearing, at about three times the price of. one-year-old. You can spend your money for which you please, your money being your own, but if I were to buy them, I should take the very cream of the one-year-old vines and pay the price; the two-year-old vines I would not buy if one-year-olds were to be had, and the three-year-old vines I would not buy at all, unless I was cold and could not get any other fuel. My experience in setting out vines and trees has been this: that the young trees and young vines always succeed best in the end. People are very impatient when they set out trees, and they get large ones, assuming that they are going to bear immediately. They may get a little fruit the first year, but the result in the end, I think, is not as good as it is where young trees are bought. If we buy yearlings, we are very sure to get the whole system of roots; if we buy two-year-old vines, we do not get the whole system of roots, unless they have been transplanted. [The speaker here illustrated, by a sketch upon the blackboard, the growth of the roots the first and second years, and said that when a two-year-old vine was bought, the nursery-man cut the root just about at the point where the second year's growth began, so that the purchaser got only about the same amount of root that he would if he bought one-year-old vines.] If a little pains is taken in removing a vine when it is a year old, the whole system of roots cut off the length of two or three inches and re-set, then we get a new system of roots from the whole centre, and they do not grow so far; then we are more likely to get a strong vine. Hence if a vine has been grown two years, it is not so objectionable, although it is not, in my view, quite so good as a first-class one-year-old vine.

But there are a great many vines that do not fairly start the first year; they just live, and that is all; they make no roots of any consequence,—perhaps two or three inches, just enough to live over. If these vines stand another year, they are almost in the condition of a cutting in the spring of the sec-

ond year, and at the end of the second year, they will make a good vine, as they should have done the first year, but failed, by reason of not starting early enough. I buy young vines because I get their whole system of roots. It is the roots I want; I care nothing about the top of a tree or vine; I will make the top, if you will give me the roots, but I cannot make roots in open-air culture, having nothing but the top to aid in producing them.

The question is frequently asked, When is the best time to set vines,—the fall or spring? The best time to do it is when you can do it best, without regard to the season. If your land is in good condition, if you can get your vines early in autumn, and can set them out, you will obtain a little better result the next year, than you will if you set them in the spring.

If you set them in the spring, you avoid the risk of loss if the winter should be particularly unfavorable. Some three years ago, I set out a thousand vines in the autumn. They arrived very late, about Thanksgiving time, and I had just time to set them into the ground before it froze up. The land was bare and exceedingly dry all winter, and the following spring was dry, up to the first of June. The result was, that seventy-five per cent of the vines never started at all. That was a very severe experience; it is not likely to happen again in my time; but still, it is a thing that does sometimes occur. Nevertheless, I would set out vines in the autumn, in the face of that experience, if I could set them out early, the soil being in a proper condition.

And this matter of the proper condition of the soil is worthy of a moment's consideration. If your soil is mellow, it is all right as far as its mechanical texture is concerned.

If it is too wet, it is in an unfavorable state, whether it is in the fall or spring. Sometimes, in autumn, it is very wet, and there is no time when the soil is mellow and really just right to set out grapes. In that case, it is better simply to heel them in, and wait until the following spring. It is important, either in the fall or spring, to set them out as early in the season as possible, so as to give them the advantage of all their root-forming power, that they may start early and strong.

A word or two upon the mode of setting. There is a great deal of talk in the books about the pains that should be taken in setting trees and vines. If we set out a very large tree, it is necessary to take pains, the risks are great, but if we set out little ones, the risks are very small, and no great care is necessary. You will find sometimes that you are directed to make a little mound, and very carefully place all the roots in a particular way, packing the ground very carefully, and spending a great deal of time upon it. This seems to me to be totally unnecessary. If you have vines of the size I have indicated, with roots about a foot long, it is very easy to set them out rapidly. I have, with the assistance of one man, set out six hundred in half a day, and I never could see but what they grew just as well as if we had spent ten minutes upon each one. The ground being in perfect condition, he removed a quantity of earth with a shovel, I put the vine in its place, he threw the earth back, and I put my foot upon it, and that was the end of it.

They should not be set very deep. As I have indicated, most of the roots were about five inches below the surface. Of course, we do not want to set them any deeper than that.

My custom is, to place them about four inches at the centre, where the roots are given off, with the ground sloping perhaps an inch down to the end of the roots, so that they shall be at the depth which they prefer to keep, about five inches.

One difficulty in setting them deeper than that is this: a new system of roots will start out above the old one the very first year, and those roots, in my experience, invariably run away with the vine. The roots of the lower system gradually come to a stand-still, and finally decay, and the vine seems to be lifted out of the ground, leaving the roots badly exposed, with no stem below the surface at all. This is to be avoided.

Where surface-roots have been made the first year, it is important to remove the earth a little and cut them off. There should be but one system, one story, so to speak, of roots.

They should all start from one point, at the proper depth, and it pays, I think, to cut off all the others. But if the plant is set shallow, not more than four inches deep, and the nodule where the roots start from kept out of ground, of course none will grow from that point.

After the vine is set, it requires but very little care the first year. There are two systems recommended of growing it. One is to take the shoot that grows, train it to a stake, and allow nothing else to grow. It makes one cane perhaps two or three feet long, the first year. Another plan is what may be called "the lazy man's system"; to let it alone. In that case, it will not make one shoot only, but three or four, or half a dozen will grow; that is its natural tendency.

There are some advantages in "the lazy man's system." I very seldom patronize that kind, but in this case I do. I think we shall find that the character of the top of any plant determines to some extent the character of the root.

If a grape-vine makes a shoot three or four feet long, with no side branches, I think its tendency is to make one root three or four feet long, with few side branches. If it is allowed to grow as it will, or if by pinching off the leading shoot it makes half a dozen branches, you will be likely to find half a dozen roots corresponding. I do not say that it will follow in all cases, but I say that is the tendency. You will find this illustrated in our grass-lands. Take any of our closely-shaven lawns, that are kept cropped all the season; there is no depth to the root; you can cut the sod with the greatest ease imaginable. On the contrary, herdsgrass, for instance, that grows up and goes to seed, has very few fibrous roots on the surface, but it goes down deep; it has a tap-root corresponding to its stem. I think that the class of trees which make an upright shoot, or an extension of that kind, are apt to have roots of the same character—tap-roots. Take the walnut, for instance. I had some experience in planting walnuts years ago. The first year, each plant made a straight stem about three inches long, and nothing else. I transplanted them, and to my surprise, I found a root certainly ten times as long as the top. The habit of the grape is to make an upright shoot and a down root. We do not want to encourage the formation of a single root in a grape-vine. We want to supply it with a whole system of roots, and I think in this way we are more likely to do it, than we are by growing it as a single cane. There is one thing, however, that ought to be thought of. If you let it alone, if you let it sprawl, you are very apt to break off the tips of the shoots

in cultivating ; you thus continue to prune it, and you prune it too late in the season ; you not only check the system of long roots, but you check the making of roots at all. If you break off the tops of the shoots, you stop the growth of the roots, and you do not get the same growth at the end of the season. Hence you want to train it. That can be done by putting a stake by its side. Occasionally, if the tops spread round, so as to be in the way of cultivation, pass a string around, so as to tie it all up in a loose bundle. But if it does not make growth sufficient to be in the way, let it alone.

I must say a word about the cultivation, which is the same for every year. I would cultivate the whole of the soil, but I would cultivate very shallow. I never disturb the earth in my vineyards more than about an inch and a half deep. This I have done the last two years with an implement perhaps best represented by a Thomas' smoothing harrow. I did not get his harrow, because it was not in proper shape for my use. I made an ordinary **V** harrow, which spread four feet, that being adapted to the distance between the rows of vines.

The peculiarity of this is, that it is filled with small, round, steel teeth, half an inch in diameter, that slope backwards an angle of about forty degrees. They are placed an inch apart. It is a kind of a comb, or horse-rake. It goes over the ground and smooths it, and cultivates it as deep as you please.

In the spring, when the ground is hard, it should be loaded just enough so that it will enter the surface and break it up ; and it should be used often enough through the season to keep the ground mellow. It will kill all the weeds, if you use it the right way. The best time to kill a weed is as soon as it is born, before you can see it. That is the most profitable time. When the seed germinates, and is just ready to break through the ground, or even if it has just broken through, the slightest disturbance of the soil disarranges its connections, and it dies in the presence of a hot sun. But let it get hold of the soil and make roots, and then, even if you disturb it considerably, you do not kill it ; it has made a hold upon the soil ; it lives in spite of you. Hence an implement of this kind is only adapted to the destruction of weeds in their earlier stages. If they go on later than that, you must take a different implement to get them out. I have used this

for two years with very satisfactory results. The ground is kept mellow and free from weeds through the whole season, and with the minimum amount of labor and expense.

I may as well here consider the subject of distance, direction, etc. My experience has led me to this conclusion: that a single vine should occupy, in this locality, about forty-eight square feet of surface. I have set them out usually in rows eight feet apart, the vines six feet apart in the row, which gives about nine hundred vines to the acre. The rows should run north and south, and for these reasons: If a row runs north and south, the morning sun shines upon the easterly side, the afternoon sun shines upon the westerly side; every leaf gets the sunlight in the course of the day. If the rows run east and west, the sun shines all day upon the south side, and the leaves upon the north side always make an effort to turn round towards the sun. They get all they can. They get, perhaps, nearly as much sun, in the aggregate, with the rows in this direction as the other. But the great difference is this: When it comes September, about the time of ripening, if the rows run north and south, the sun shines directly upon the ground for three or four hours, during the middle of the day, and it warms up the soil, and that soil holds the heat during the night and radiates it. The temperature of a vineyard will thus be some degrees warmer than otherwise. If, on the contrary, the rows run east and west, the vines shade the entire ground, and hence you lose a large part of the heat. The moment the sun disappears, you have no stored-up heat to carry your vines through the night. This, in the time of frost, is sometimes very important.

At the close of the season, the vines are to be pruned. Well, why prune them? I am not in the habit of performing operations that I cannot give a reason for. I may not give you a reason in all cases, but I am not in the way of doing any of these things unless I can give a reason satisfactory to myself. A great many trees and vines are pruned because it is the fashion. There is an idea that they must be pruned. A man tells me that he has not succeeded in raising grapes; he has not had them pruned for two or three years, and he guesses that is the reason,—not having an intelligent idea of what pruning is for. A grape-vine should be pruned for this

reason: By pruning in the winter, by cutting off the top of any plant that lives through the winter, we get a preponderence of root over top, and the result is, that the next season the top starts with a great deal of vigor; it makes an increased growth in consequence of this winter-pruning. If, on the contrary, we had pruned the roots instead of the top, it would have taken the whole season, under favorable circumstances, for the top to have made enough roots to supply the place of those removed. To get a strong growth, we cut away the top, so that the roots may have the preponderance, and give us a strong growth the next year. The pruning in the autumn of the first year should be this: Every vine should be cut down within two buds of the earth. No matter how much it has grown, whether it has grown three feet, or four feet, or one foot, every vine should be cut remorselessly down to the ground, leaving only one or two buds to start from the next year. Then we have simply one or two buds, with a strong system of roots underneath the ground, to start the second season. That season we shall get a strong growth, and it should be treated very much as it was the first year. Of course, there will be a great deal of top, and it will be necessary to have, perhaps, a long stake and to take more pains to keep it out of the way of the cultivator; but it should be allowed to grow pretty much as it did the first year, because we are not yet ready to produce fruit, and if we let it grow in this way and make this system of horizontal roots, a great many of them, the second year, it is more favorable for the vine than to make a few long roots. Cultivate the same as the first year, simply keeping the ground mellow and free from vegetation. In the autumn of the second year, we want to prune again. Here is where it comes hard. We have got a good vine; it has grown four, five, six, seven or eight feet; what are we going to do with it? Cut it off down to the ground, just as we did the year before. You will say, "I have lost a year. I have grown all this wood, and I am going to throw it away." That seems to be a waste of time, but it is not; it is a thing we have to learn somewhat by experience. A vine should be cut down the same way the second year as the first, leaving only one or two buds to start from the third year; then we are ready to

go on and make some headway in the production of fruit. If the vines were very strong at the time of setting and should make unusual growth for two years, a part of them might be allowed to fruit a little the third year, but as a rule they should be treated as described.

It is necessary the third season to erect a trellis. I am talking about my system, not about any other man's. Of course, if a person grows his vines under a different system, he will take different means, but under my system, it is necessary to erect a trellis the third season. The trellis I have made, as shown on p. 292, is this:—

The posts are made of two-inch-square chestnut. It is, perhaps, not quite as cheap as unsawn timber, but it is very much handsomer, and if your vineyard is in sight, it will look very much better; and if it is not in sight, it will be apt to be out of mind; "out of sight out of mind." You want it in sight. These posts are set six feet apart through the whole vineyard, one post for one vine; they are set two feet and a half in the earth and five feet and a half out, being eight feet long. My custom is, to set the *end* post right by the side of the first vine, which makes it nine feet from the next one. The others are six feet apart. I put a brace in at the end, bracing the outside post to the foot of the next one, which brace is set into a little shoulder just sufficient to hold it. Then, upon these posts, wires are stretched. I have used various kinds, but the last was number 15 galvanized iron wire, which I am inclined to think will give me better satisfaction than anything else. The lower wire is placed twenty inches above the ground; a little higher than I used to put it, for the purpose of keeping the grapes on the lower part of the trellis out of the dirt. A year ago this last autumn, there were heavy rains through the month of September, that spattered a great deal of soil upon the grapes, and it was very difficult to get it off. It troubled me so much that I decided that the lower wire should be raised to about twenty inches from the ground. The next wire I put fifteen inches above that. You will see the utility of that by and by. The next wire is fourteen inches above the second, and the next one is fifteen inches above that. There are four wires. And here I may say, that any gentleman who is at

all interested can find all this illustrated a mile and a half from here, at my place, "Pomoland," where I should be happy to see any of them. I can show them the whole thing, in all its stages, at the present time.

Now, at the commencement of the third year, the process is this. I allow one shoot only to grow from each one of these vines. The end vine of each row is, to some extent, an oddity, and I will say nothing about that. I will take the second vine. The growing shoot is led up to the first wire, thence turning one way (they all turn the same way), and grown along this wire during the season. The next vine is carried up to the third wire, and grown along in the same way to that. The next is trained on the first wire, and so on in that way, alternately. If your vines have done well, you will get a strong, horizontal shoot, six feet long. The object is to grow this upright stem, and an arm six feet long, supposing your vines are strong enough. Let them grow as much as they will. All the laterals that show themselves should be nipped out, excepting one leaf. That is, when a lateral starts, you pinch off the point of it, after it has made one good leaf. If it starts again, repeat the operation, and do this as often as it occurs, being careful, however, not to break off the point of the leading shoot, because, if you break that, you lose two or three weeks in time, before it recovers its growth. When the shoot has grown six feet, the end should be nipped off. You want to stop it at that point, but not before that. If your vines have done well, they will have made a very strong cane.

Then they are to be pruned in the autumn of that year. The pruning consists in simply cutting off the superfluous laterals. If the growth has been small, cut it back in part. If it is not capable of bearing anything the next year, cut it back within one or two buds of its origin. Cut it back every year, until it makes wood strong enough to bear the next year, whether it takes two years or twenty years; that is the rule. If it is only strong enough to show a little fruit, you may cut it back half way, and allow it to bear only half a crop of fruit. If it is not able to bear even a single cluster, then you may cut it down near the ground, and let it start anew.

At the commencement of the fourth year, we begin to have some idea that we are going to get a return.

Mr. Lewis. Will you tell us what you tie your vines to the trellis with?

Dr. Fisher. Cotton string. It is a material that we get from men who deal in paper-stock; but anything will answer that you can tie a knot with, it is entirely immaterial what.

Two years ago, there was an invention gotten up, made of wire, that was highly recommended by some gentlemen engaged in vineyard culture, but my opinion is that they never practically tried it themselves. They looked at it, thought it was a good thing, and recommended it. I bought some twenty thousand ties, used them the first year, and I thought they were almost as good as string. Ever since then, they have been a perpetual nuisance to me; I will give any man three times what they cost if he will go and take them off. I have gone back to string. The strings should be tied loosely, because they have got to stay there another year, and the vine will enlarge. My habit is, to put my finger in and tie the knot over my finger, and then there is plenty of room for the vine to increase in size.

At the commencement of the fourth year, we shall find starting from every one of the buds, a shoot; and these shoots, after they have shown their clusters of grape-buds, and have made two or three leaves beyond the last cluster, should be pinched at the ends. I do not want them to extend; I do not want to go on making wood, as my object is to get some half dozen large, thick leaves, to carry my crop. Hence, as soon as I can see the top of the shoot beyond the last cluster, so as to pinch it, leaving two or three leaves, I pinch it. I then allow the shoots to progress for some little time, until they get pretty well grown, so that they will not break by bending, and then they are all tied up to the second or fourth wire, as the case may be. Simply a string tied round the shoot and the wire holds it. This is done some time before they blossom. If you attempt to tie them up too early, as quick as they reach the wire, they are very apt to break. Therefore it is best to wait until they get considerable strength, from becoming woody, and you can then bend them with freedom. Then tie them all up at once, make a

business of tying. Laterals will start out on these upright shoots during the season, and they must be pinched at all times as laterals were the first year, leaving one leaf every time. At the time I pinch off the tops, I also pinch out the surplus grapes. This is one of the difficult things to learn; and here, perhaps, is as good a time as any to say what a vine can do. You remember that I told you that we were away up at the northern limit of successful grape-culture. We have to fight against adverse influences all the time. We should be exceedingly careful not to ask our vine to do any more than it can do well. If we were further south, we might perhaps ask it to do more than we can here, but we do not want to attempt to grow any more grapes than we can be sure of growing to perfection. I may as well say at once, that vines having this amount of ground, in a good soil in this locality, are able to carry, in my judgment, about six pounds each, and not more; I have had them carry twenty pounds, but I never had them carry twenty pounds two years in succession, nor ten. You can carry about six pounds per vine, and continue it successfully, and make it sure. To get the six pounds you proceed in this way. You will have, ordinarily, about twelve upright shoots that are bearing, on an arm six feet long. Now, if your clusters weigh a quarter of a pound apiece, it takes twenty-four of them to weigh six pounds. If they weigh half a pound apiece, it takes twelve; if they weigh three-quarters of a pound, it takes eight. Now, we have about twelve shoots that will show from two to four clusters each,—how many shall we leave? That depends upon your experience. I attempt to grow clusters that weigh three-quarters of a pound each; I do not always succeed. Upon an average, it is very difficult to get clusters that will weigh half a pound. I get ordinarily a few clusters that will weigh a pound; I get hundreds that will weigh three-quarters of a pound, and thousands, I think, that weigh more than half a pound each. I do not like to get a cluster that weighs less than half a pound, although I do get a great many such. Then, if I raise twelve clusters on my twelve upright shoots, and each one weighs half a pound, I have got my six pounds. I am talking of the Concord grape all the time. I will tell you why by and by. Then I cannot let

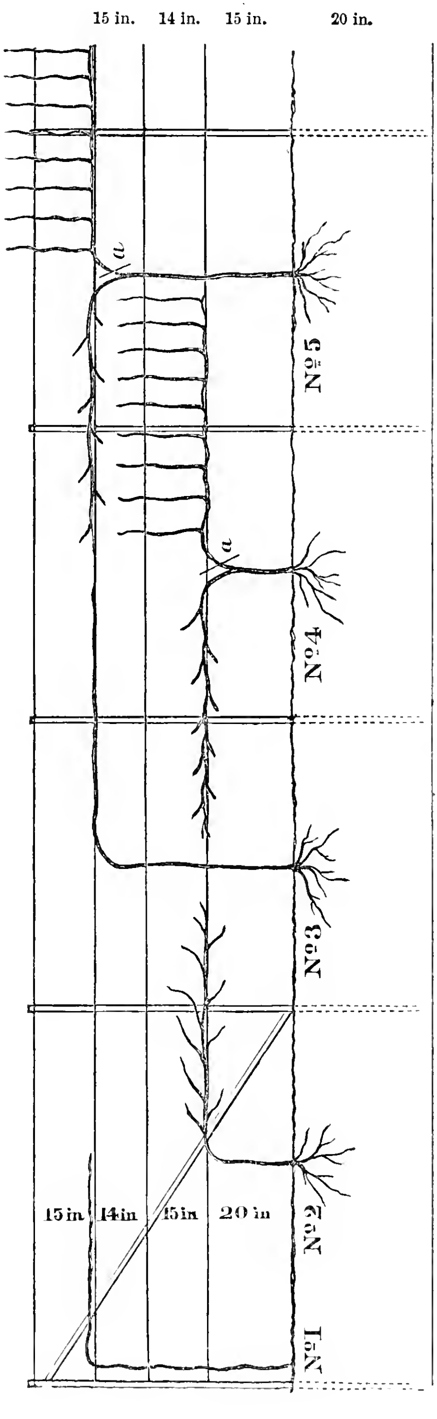
these shoots bear but one cluster apiece. The best time to pinch the superfluous clusters off is as quick as you can see them; as soon as you know they are there. It is just like killing weeds. My custom is, when I pinch off the point of the shoot, to pinch off all the clusters but one. Sometimes, the second cluster is the finest, but generally the one nearest the arm is the best. I then have but twelve clusters; if my clusters are small, I leave more.

Now, as to the size of these clusters. It may not perhaps have been thought of particularly, but their size is already determined for the next year; that is, the grape-crop for 1874 is already fixed, so far as the number of clusters and the number of berries on a cluster is concerned, but they are only in embryo; the size of the individual berries is to be determined, of course, afterward, but the whole crop of next season, so to speak, is bottled up in the buds, and anything that you can do to them now does not influence the crop of next year. There are a great many absurd notions about this. A man having an apple-tree that had been barren for a great number of years, applied a lot of oyster-shell lime in the fall, and it bore an abundant crop the next year. Hence, he said, that if oyster-shell lime was applied to an apple-tree, it would make the tree bear, not knowing that his apple-crop was virtually made the year previous, before he thought of his oyster-shell lime. The crop was there; it was simply developed the next year. It is so with grapes; but you can tell the character of them almost as soon as they show. If the clusters are large, do not leave so many of them; if small, leave more. If, in your judgment, they will weigh about a third of a pound each, leave eighteen clusters; if half a pound each, leave twelve.

At the same time you get this crop you are to look out for the next year, and there is where grape-growers are especially likely to fail. They all get this crop, but they do not get the next one. Everybody has success when his vines are three or four years old, because they bear their first crop, and there is no difficulty whatever in getting a large one; the difficulty is in getting the succeeding crop. That is provided for in this way. Anywhere upon the main stem, where a strong bud starts, the shoot arising from it is trained up and

along the wire, in an opposite direction from the bearing arm. That is to provide you with fruit for the following year, as the other has given you fruit this year. More care should be taken of that shoot than the bearing one, because, if you do not get that shoot, you do not get your next year's crop. The object of this cane is simply to give you a crop next season. You want to get as fine a quality of grape as you can for this year's crop, and you want to get as strong a cane as you can for the succeeding year. You attain the first object by pinching your shoots early, as I have indicated, to get large leaves, well developed, and by keeping down the superfluous growth afterwards, and by thinning your fruit. The second you get by allowing the vine to grow one cane, pinching out the laterals, and stopping it when it goes beyond six feet, and then letting it take care of itself. At the close of the fourth year, the pruning is simply this. Here is a vine [a vine was here exhibited] which is a fair representative of hundreds which I could show you. Here are the upright shoots, twelve of them, which bore the crop the past year. These upright shoots carried a cluster apiece, perhaps one or two of them bore more. I allowed rather more than twelve to grow this year, because the clusters were not so large as usual. The others were pinched off, and every lateral was pinched off. That is the way the whole vineyard looks to-day. Now, the pruning is just this: with a small saw or pruning shears, all the vine that has borne fruit is cut off at *a a*, and the new cane is left precisely as the other was the year before. The pruning, you see, is extremely simple. It makes one cut to a vine. It is a wicked way of pruning, in the eyes of most people, but it is a good one.

The fifth year, you have got just what you had at the close of the fourth; you have simply one arm, only the arm runs in a different direction. One year all the arms will run towards the south; the next year they will all run towards the north; the next year towards the south again. That is, the bearing arms grow one way and the growing arms the other; they change places. The arm that has borne your crop being cut away, the remaining arm will bear the crop the next year, and you grow a new one on the other side for the succeeding crop. You have one cane bearing a crop, and you have a



The cut shows the arrangement of the trellis and the vines in different stages. No. 1 is the end vine, and not described in the text. No. 2 shows a vine at the end of the third year, not pruned. No. 3 has been pruned. Nos. 4 and 5 show two vines at the close of the fourth or first bearing year, before pruning. The lines *a a* indicate where the cuts are to be made.

cane that grows six feet for the crop the next year. The vine bears no more when it is one hundred and seventy-five years old than it did when it was five years old. I do not know that it will live to be one hundred and seventy-five years old—I never have tried it—but as far as I have tried it that is the result. You will see that it is easy to transform any old vine with this system in one season, and without losing a crop. If you have an old vine that does not do anything, cut it down except one cane that grew last year, and then grow a shoot in the opposite direction for the next year, and you have the whole system at once. The difficulty is, that everybody wants to get too much for his money. A vine is only capable of doing a certain amount. Now, the result is like this: I had a pretty severe experience two years ago; I allowed my vines to bear a good deal more than I have indicated—nearly double. What was the result? The clusters, of course, had as many berries on them, because they were made the year before; it did not make any difference about that; but the berries were smaller, they were lighter color, they never became black; they did not have much bloom, and I did not succeed in growing a single strong cane for the year after. Those grapes got caught by the frost, and they were nearly all thrown away. The wood was very poor for the next year, and I did not get a full crop then; I tried to get a big thing, and did not get anything. Now, I know better, and I do not attempt to get more than about six pounds of grapes from a vine. I can get six pounds every year, and it does not make much difference what the season is. This past season has been a very poor one. I do not know what our grape-growers will say generally, but I think it has been poor for this reason: that the average temperature from May to October has been about two degrees lower than in the average of years. That is enough to make a great deal of difference in the grape-crop, which wants a large aggregate amount of heat within a certain time to bring it to maturity. Some seasons we could get a larger crop than in others, if we knew in advance what they were to be; but, taking it through, it is not safe, in my judgment, to attempt to get more than six pounds to a vine. It is easy to see the difference in the quality of the grapes. The grapes

from a vine that is overloaded are only purple, not when they are ripe, but when they have got as ripe as they can get; they have little or no bloom, and they are acid; they will make a man's stomach ache if he eats many of them; but if the vine is not overloaded, the berries are large, the grapes are black, the bloom is a very deep blue, and the quality is such as will make people deny that you grew the grapes out of doors; they will say that it cannot be done, that you cannot get so much sugar and so much high quality into a grape out of doors. A grape-vine can do a certain amount; it is just like everything else, and just like everybody else. If an ordinary man attempts to spread himself out very wide, he will necessarily become very thin. If the public would make no discrimination in the quality, of course you would grow the larger quantity, but the public know better, especially in the matter of luxuries. It is largely the beautiful things that people are induced to buy. If clusters of grapes are large, if they are handsome, people will buy them; if they are sweet, they will go for them again, and are willing to pay the difference in cost. Grapes have been sold in the market this year, tons and tons of them, that were not fit to eat; but the public bought them, as being the best they could find. Another thing: a great many people do not wait until grapes get ripe before picking. Some of them never would get ripe if they did wait, but they do not wait to let them get their best quality; as quick as they get half colored they are sent to market, and the people eat what comes to market, asking no questions. They may say they are not very good, but they buy them nevertheless.

I do not begin to market my grapes until after the first of October. Perhaps you may say, "It won't do for me to do that, because my grapes would freeze up before that time." It is not so with me. Ordinary frosts do not hurt the grape at all. It is not hurt a particle until you make ice in it, and after the grape has got ripe, it will not freeze, ice will not make in it, until the temperature is as low as twenty-nine degrees. I dislike to have frost come upon a vineyard, because it will retard the ripening by its action on the leaves, but if grapes are nearly ripe, I care nothing for the frost, so far as the grapes themselves are concerned. I have kept a record

for seventeen years, of the time of the first freeze, and the temperature of that freeze, and the earliest date at which ice would be made in a grape that was nearly ripe has been the 17th of October, and that only once; the 21st of October is the earliest, with that single exception. Whether that will hold good in other places, I do not know. If you are in a location where you get freezes earlier than that, you are simply further north than I am; you are out of the range of the best success and must be content with less than six pounds to the vine, if you succeed at all. Here I can succeed in getting my grapes up to a condition of very fine quality before the 17th of October. Some favorable years, they are very good the first week in October, but ordinarily, I commence harvesting soon after the first of October; the main crop is not picked until about the last of the season; when it gets so that it is risky to leave them out any longer, then I pick them. In this way, the quality improves all the time; there is a greater development of sugar. It is almost impossible to keep them on the vines too long, but I have found one or two years that they did depreciate a little on the vine; after they had attained what seemed to be their perfect maturity they did not improve afterwards.

I have said that I grow the Concord. I have been growing grapes for market nearly twenty years, and the result of all that experience is this, that if the Concord were blotted out of existence, I would not attempt to grow a pound of grapes to sell. That is putting it in as few words as I can do it. I set two years ago a vineyard of two thousand vines, nineteen hundred and seventy-five of which were the Concord; I set out twenty-five others as playthings. People frequently come and tell me they want some grapes, and ask me what they shall plant. I tell them to set the Concord. They say, "I have got a vine of the Concord, what else shall I set?" My advice always has been, "Plant Concords all the time, until you get as many as your family can eat, and then fool away your money on other varieties as much as you have a mind to." There are other grapes that are better, there are other grapes that are earlier, but there is no vine that combines all the good qualities of the Concord; there is no other that can be relied upon. I do not know of any other that will uni-

formly give crops, aside from other difficulties. The Hartford Prolific is earlier than the Concord, and more sure to ripen, but early grapes now do not bring the price they used to ten years ago. The South furnishes us with early grapes cheaper than we can raise them. The moment the Concord is ripe, I cannot induce any one to eat the Hartfords; besides that, they fall from the clusters very badly, so that it is exceedingly annoying to attempt to market them.

About the time of pruning. I have something different to say from most people about that. I am frequently asked, "When shall I prune my vines?" I have said to-day, in reply to one or two inquiries, "Prune them any time between now and next June, whenever it is convenient." People open their eyes in astonishment when I say that. They think they must not prune them in spring, because they will bleed. Well, we heard something yesterday about the bleeding of maple-trees, that have been tapped for many years, and they have not died yet. Now, it is no use to talk about such things without some knowledge. It is one of the simplest experiments to try in the world. Two years ago, I took thirty-seven vines that had not been pruned at all. Commencing the first of May, about the time that they began to bleed, I pruned one vine a day until they were all thus treated. At the close of my pruning, the new wood on the last vines had made two and a half feet growth, long enough to be pinched off and tied up. You see I have had a good test. I wanted to ascertain the comparative difference, and I watched them all through that season and the next, and I was unable to appreciate the slightest possible difference in those thirty-seven vines, from beginning to end. Is not that a conclusive experiment? I have pruned vines at all times. Theoretically, I would prune them as soon as possible after the fall of the leaf. In some very severe winters, such as we had two years ago, I have no doubt that vines might be injured by too much top being left on. The severe cold, together with an extremely dry soil, would probably injure them; on this account it would be better to cut them off in autumn. Aside from that, I do not know any reason why they should be pruned at that time rather than in the spring. If you are inclined to be lazy, prune them in November, and then you

will be sure to have it done; but it is entirely immaterial whether you prune them one time or another up to the time of commencing growth.

There is another very foolish direction given, and that is, that you must prune your trees or vines at a time when the wood is not frozen. It makes no possible difference whether the wood is frozen or thawed. It is all sheer nonsense, this idea that gets into the public prints and is perpetuated without any rhyme or reason. The vines, to be sure, if pruned in the spring, will bleed; there are two or three weeks in which the grape-vine bleeds from a recent cut; but they will stop bleeding; they will all begin to bleed about the same day and stop about the same day, and, as far as I can see, it makes no possible difference whether you prune them at one time or another. This experiment of mine was conclusive to me, and I have not gone any farther in that direction. I have pruned a whole trellis, and there would be a running stream of sap, but in a few days that would dry up, and the vines started just as early and made just as much and as strong wood and carried just as large a crop the next year as any others. Now, do not say, "It makes no difference, and therefore I will not prune my vines now, but wait until next June"—and then wait. That won't do. I supposed that cutting off the wood after the shoots had made the progress they would by that time, would check the growth of the vine, and I have now no doubt that would be the case with a tree and with grape-vines grown under some circumstances. If I prune a tree severely just after it has leaved out, as a general thing it will not make any growth that year; but the pruning of a grape-vine grown as here directed is so severe that there is still a preponderance of roots to make it up. I should not want to prune a vine after it had commenced leaving out, but up to that period one time is as good as another.

In regard to the summer pruning of the tops of the vines, I will say that I think it has a tendency to arrest the elongation of the roots and keep them more at home. If you allow the tops to extend from year to year without pruning, the probability is that your roots will be, not in a compact collection, but merely one or two roots of great length. I have not tried it to see what the result would be. There is a fal-

lacy in the public mind about the fibrous roots. If you go to buy a tree, you will be apt to select one that has a large mass of fibrous roots, and you think you must stuff just as many of those roots into the ground as you can. They are perfectly worthless. You might just as well cut them all off. Perhaps you cannot all see through that. You have a plant of any kind with half a dozen roots, upon each of which there are smaller rootlets. You, perhaps, in a circle of a foot, can find a thousand fibrous rootlets. Now, supposing those thousand rootlets all live, and you have got a thousand roots starting from your tree within a foot, where are those thousand roots at the end of ten years? Have you got a thousand roots, or have you got only the original four or five? If you have only got four or five, what has become of the rest? They simply act as the leaves act. They are deciduous. They are thrown off every year. These fine, fibrous roots do not live; they die at the close of the year, in the same way that the leaves do. It is only the roots that are larger than those that live. Hence, in buying trees, you want a tree that is full of small roots, but not the finer fibrous roots, because those are of no use.

QUESTION. Which end of the stakes do you think it is best to put into the ground?

Dr. FISHER. Ask me twenty-five years hence and I will tell you, for I have them set both ways. Whenever they decay, if you and I are here, I will tell you which decayed first.

QUESTION. Will you tell us how you pack your grapes?

Dr. FISHER. I have a series of shelves about five feet long and two feet wide, or a little larger, upon which the grapes are placed. These shelves are separated about four inches. Each one of these is placed upon a stretcher and carried to the vineyard by two men, and grapes are picked and laid upon them, a single layer, as close as they will lie. They are then carried to the fruit-room and piled up one above the other, and they are there left until they are marketed. I have never succeeded in keeping grapes to any advantage. All I can do is to keep them where they are. They never grow any better; they do not improve; they tend to depreciate every moment from the time they are picked, and the object is to have them depreciate as little as possible. They

should be kept in a cool temperature. They should be kept so dry that they will not mould, and they should be kept so damp that they will not shrivel. I can keep them in perfection up to about the first of November. The quicker I get them off my hands after that time the better I feel. That applies, of course, to the Concord. There are other grapes that will keep in perfection, but there is no object in keeping the grape much beyond its season. You can keep it some little time, but if you attempt to keep it much beyond its natural maturity, it loses all its distinctive qualities; it is no longer what it was.

Mr. Hyde. What do your grapes bring?

Dr. Fisher. That is a personal matter. They bring a price that satisfies me. They bring a price probably fifty per cent. higher than those of any other grower that I know of, except some few men who adopt this system of growing.

Mr. Kilburn. You say we are on the northerly limit of grape-culture. Might not the formula be changed to this, that our grapes are too late for this latitude?

Dr. Fisher. Mine are not. They are just right.

Mr. Kilburn. It was said, some few years ago, that we were lacking in an early potato, but that want is supplied by the Early Rose, and instead of depreciating, it is better this year than ever before. New strawberries and new grapes are being thrown into the market every successive year. Now, the time may come when we shall have an early, prolific and good eating grape that will grow in Quebec. Mr. Bull, who originated the Concord grape, says that the man who gets up an early, prolific and good eating grape, will make his fortune; which is as much as to say it has not been produced yet.

Question. Do you practice root-pruning at the time of planting?

Dr. Fisher. Yes, sir. If the roots are longer than eight or ten inches, I prune them to that length. I want them to start new roots near home.

Question. Do you have any preference in buying vines from root-cuttings or layers?

Dr. Fisher. The best vines are from layers, because they make a very strong system of roots in one season. There is no other advantage. They are worth more money, because you get more roots the first season.

QUESTION. Is it worth while to cover vines here?

DR. FISHER. That is an important point, and one to which I have not alluded. You will find that grape-vines grown in the way I have suggested will ripen the new wood as thoroughly as white oak will ripen its wood. The grape-vine is just as hardy as the white oak. If it is not ripened, it will winter-kill. If it is ripened, it will not. If you overload the vine, if you attempt to grow so many grapes that you do not succeed in ripening the wood, it will winter-kill. I have not laid down a vine for five or six years, and I have not had a vine killed in that time, except one or two that mildewed. And that leads me to say a word about mildew. Nobody seems to know the cause of mildew. I may as well confess my ignorance at the beginning as afterwards, but perhaps now is as good a time as any to make a suggestion to observers. A number of facts have forced themselves upon my consideration, and my experience in cultivation under glass has given me what appears to be an important proximate cause of mildew. It is a thing which I think has not been investigated by any observer yet. Having the suggestion made to me some years ago by a certain occurrence under glass, I have watched the operation of mildew ever since pretty carefully, and so far as I have gone, the theory will stand, but it requires a long time to make it a certainty. I would like to suggest it to other observers, to put them upon the track. My theory, as suggested by those facts, is this: that a leaf developed in a moist atmosphere, is exceedingly prone to mildew at a certain stage of its growth, in a dry one. If the atmosphere is uniformly of the same hygrometric state; if there is about the same amount of moisture suspended in it all the time, as there is not, unfortunately, there will be no mildew, as happens in California. But our climate here is exceedingly variable; one day will be warm, having an average amount of moisture of seventy-five or eighty per cent., with a clear sunshine, and the next day we will have it down to twenty-five per cent. in the same clear sunshine; the amount of humidity in the atmosphere varies continually between those two extremes. Now, I have noticed that the out-door mildew comes on like this. After a wet June, about the tenth of July, when it makes its

first appearance, there will occur two or three days in which the hygrometer indicates an excessive dryness of the atmosphere. If a day of this intense dryness comes on, you will have a flash of mildew come over your vines all at once. It will come within a few hours. The next day perhaps there will come a rain, and the mildew on that day will not make any progress, but the flash of mildew that came the day before all stays there. The next day perhaps it will rain, and there is no danger. You go out that day and you for the first time see some mildew, and you will say that it is the wet weather that makes those vines mildew. You are a very careless observer. You have not watched it all the time. Even the slightest outward appearance of moisture in the atmosphere appears to stop its growth all at once. It ceases to grow for two or three days, and then there comes another day of intense dryness, and that mildew increases enormously. This last season was a fine negative illustration of this theory. The month of June was not only dry as far as the rain-fall was concerned, but it was excessively dry hygrometrically. The streams were all very small, and if there came a rain, the moisture would be dried up by the next day. The winds came from the north-west, and sucked up the moisture like a sponge. In July, there came a rainy season, there was a great deal of humidity in the atmosphere, and the result was, I did not see a spot of mildew during the whole season. That, of course, is negative proof only, but on the other hand, a hygrometrically wet June followed by a dry July has always given us a large amount of mildew.

Now, in regard to the application of remedies, you are liable to be deceived. A man finds a little mildew on his vines. Perhaps he saw it day before yesterday, and it has not increased a bit since. He applies sulphur when it is first seen, and the next day he does not find any increase, and he says that sulphur is a specific against mildew. But he should observe what happened without the application, before he said that was a remedy. I have tried the application of sulphur under glass a great deal, and I have never succeeded in producing any great effect with dry sulphur under such circumstances, but half an ounce of sulphur volatilized on a warm surface will unfailingly kill mildew. I trust that the

Agricultural College will keep this in mind, and make some observations that will assist in sustaining my theory, or overthrow it.

QUESTION. How about fertilizers?

Dr. FISHER. I have had a belief that fertilizers would not be necessary, but have come to the conclusion now to use them. I have been trying careful experiments for three years, and I have got at the practical influence of some special fertilizers. I have taken a vineyard, consisting of thirty-five rows. To four of them I applied nothing; to the next four I applied nitrate of potash; to the next four, air-slacked lime; to the next four, commercial potash dissolved; to the next four, sulphate of ammonia; to the next four, sulphate of magnesia; to the next four, nitrate of soda; to the next four, a compound that I made. That compound was this: I bought finely-ground bone, not ground so fine but that I could detect adulterations (because I know that the men who deal in such things are not all honest), and I bought commercial potash. There is no fraud in that. I think that commercial potash is a profitable article to purchase. It is cheaper for me to buy five pounds of potash, and pay fifty cents for it, than it is to undertake to collect a bushel of ashes containing five pounds of potash, when potash is what I am specially after. I have treated my bone in this way. I have taken, say one hundred pounds, and dissolved fifteen pounds of commercial potash in a small quantity of water, and wet that bone with the dissolved potash. It will not do to have too much water, because, if you do, you make your bone pasty, and if it has once become pasty, you cannot make anything of it afterwards. There should be just water enough to moisten every particle of the bone, but still, not so much that it shall not be friable and easily separable. The effect of the solution is to soften the bone, and it gives off fumes of ammonia at once upon its application, which can be retained by the use of plaster or some other absorbent. After allowing this mixture to stand two or three weeks, I have applied it to the vines, and the result is this: where I applied commercial potash, I got an increase in the strength of the wood, in the size of the clusters, and in the size of the berries, without any tendency of the vine to make long-

jointed wood. Where I applied potash and bone, I got the same result, in an intensified degree. Where I applied the other substances, I got nothing. The vines simply said they did not want it. They said they wanted potash, and especially they wanted potash and bone together. Next year, I shall take the hint, and apply potash and bone in preference to anything else that I can get.

QUESTION. What was the quantity to each vine?

Dr. FISHER. I did not apply anything to the vines. I applied it to the ground, broadcast.

QUESTION. How much to the acre?

Dr. FISHER. Anywhere from four hundred pounds to a ton. I can tell you better if you will ask me in a few years. These experiments are all going on at this time. I applied these materials at the rate of from two to five hundred pounds per acre.

Mr. EVERETT. How many hundred weight of grapes do you get from an acre?

Dr. FISHER. Nine hundred vines, yielding six pounds each, make five thousand four hundred pounds to the acre.

Mr. SLADE. What experience have you had with insects?

Dr. FISHER. There are three insects that have given me some trouble. One is the little steel-blue beetle,—the *Haltica chalybea*, I think it is,—that comes in the spring, just as the buds are swelling, and makes a hole in the bud and eats it through, so that it does not develop. Then, on those that do develop, the insect lays an egg,—one egg upon a leaf,—and that becomes a slug that feeds upon the leaf. It disfigures it a good deal, but does not harm it much. I think in one instance a gentleman told me that a crop of his was damaged one-half by injury to the leaf. The principal injury is by eating the bud, when, of course, they destroy your hopes of getting fruit. Go round when the buds are swelling and you can see them (they are a greenish blue), and kill them whenever you can catch them. There are not a great many of them, but it takes only a few to do considerable damage. I have followed them up for some years, but for two or three years past I have not been troubled by them. When I see one of the slugs I always crush it.

Then there were the leaf-rollers that came two or three

years ago. They did not do much damage to me, but the leaves looked unsightly. There were a great many of them, and everybody supposed they were going to get into trouble; but I think not one made its appearance the next year. That was the end of them. The rose-bugs sometimes come in large numbers, so as to give considerable trouble. The damage they do is in eating the clusters of grape-buds. The rose-bugs will fly upon the vines during the heat of the day, and the next morning they will make their breakfast off the blossoms, before they expand, and a single rose-bug will eat a whole cluster, which is somewhat expensive. If you have to feed a good many, you will not have any crop, because they will eat the whole. The only remedy for them is a hand-to-hand fight. I take a little tin cup, partly full of boiling-water, into which I put a teaspoonful of soft-soap, and go through the rows early in the morning and give the vines a touch, and the rose-bugs will drop into the cup. That is the end of them; they will die easily. A little later in the morning they will drop off if you look at them. Wait a little later, till the heat of the day, and if you point your finger at them they will fly. You must take them at the right time, in the cool of the morning, or in cloudy weather. If you go over your vines one morning you will find, perhaps, five thousand of them, and the next morning you will find ten thousand; and you will say it did not do any good, but kill the ten thousand. The next morning you may find twenty-five thousand; but keep at it and you will get rid of them in time. The number always has a limit. One person can catch a great many of them in a short time. The only other insect that troubles my grapes is the two-legged one, and the fight with that, too, is a hand-to-hand contest.

Wm. C. Strong, of Brighton. I have been very much interested in the simple, clear and instructive narrative of the growth of the grape as given by Dr. Fisher. I do not know that I have any comment to make on what he has said. I agree, in the main, with his suggestions. I think I should differ with him as to the length of time required for bringing a vine to bearing. It seems to me that if a vine in proper condition is obtained, two years is quite sufficient time to bring it into bearing. It ought to bear the third year. I

think a good grape-layer is better than a one-year-old vine. I think if a grape-vine is properly taken up when it is two years old, a cutting is better than either, and there is no reason why it cannot be properly taken up; and with a proper growth for two years it ought to produce a cane of good size, so that the third year it should bear a crop.

I am not so clear upon the point of planting vines in rows, running north and south. Dr. Fisher has told us that the very best position for grape-vines is on a hill-side, sloping south. Now, if this hill-side is somewhat steep, and if the vines run north and south, it is inevitable that we get a good deal of wash. I do not see how it is to be prevented with this culture, of which Dr. Fisher has told us. With surface-culture, pulverizing the surface-soil so much, it is inevitable that there should be a good deal of wash, and these surface-roots will be laid bare and will suffer during the winter.

The method of pruning, which Dr. Fisher has recommended, is very simple, and the pruning is also very simple, and seems to be admirable. One objection, however, occurs to me. I think that the arm will grow weak, with all the growth of these laterals upright, and carrying a considerable crop.

Dr. Fisher has said that if we allow one arm to bear from the point which he indicated, we shall not get, the subsequent year, six pounds from the other arm, as we ought to. My own experience leads me to think that we should not train one arm on a level with the other, because one arm will take all the strength, and, consequently, the other will not produce so large a crop the following season. In my own experience, I have not supposed it desirable, and I doubt the necessity of renewing the main every year. It seems to me that one arm will produce within one year, and that, consequently, the method of cutting off so much growth is rather wasteful than otherwise. I do not speak of this as saying positively that I differ with Dr. Fisher, but because these points have occurred to me. But as regards the matter of planting north and south, it seems to me there is a serious difficulty, and there seems to be advantages in running the rows east and west. The morning sun and the afternoon sun strikes into the rows, and you have an early morning sun and a late evening sun, so that I am not so clear on that point as Dr. Fisher seems to be.

The CHAIRMAN. I have grown considerable many grapes, but I grow mine in an entirely different way from that which the Doctor has practised. Mine is a more sloppy way, so to speak, but I am inclined to think there is more money in it. That is, I think the ordinary farmer, who does not profess to have much skill in growing grapes, might grow them in the way that I grow them, and find it profitable; whereas, he would be likely to fail with Dr. Fisher's, perhaps more scientific, but somewhat more difficult method.

I grow grapes precisely as hops are grown, and with just as little trouble. I grow them in different locations also. I have them with rows running north-east and south-west. I have them with rows running in different directions. I have them on a south-easterly slope and a westerly slope, a north-westerly slope, a north-easterly slope, and a northerly slope; and this year I had my best grapes on a north-easterly slope. Those vines are on the side of a hill, protected by a high spruce hedge that I put around my pear-orchard. I put my posts nearer than Dr. Fisher does, and I am inclined to think they are a little too near,—six feet each way over the entire vineyard. I think I would put them six by seven, possibly six by eight, for I find in the summer, when the vines have made their laterals, it is a little difficult to pass through; but the worst of it is, the vines shade the ground a little too much.

In regard to the selection of vines, I should not differ with the Doctor much, except that I prefer a cutting to a layer, any time. I prefer one-year-old vines, unless the two-year-olds have been treated as he has described. I plant my vines shallow, at a less depth even than he plants,—from two to two and a half inches deep. They take care of themselves. I have found grape-roots running ten or twelve feet right along under the surface. I cut back my vine, as a rule, until it is strong enough to make all the wood I want. Then I begin to train spirally, just like a corkscrew. I tie it up with tarred rope-yarn, which is strong, and holds it for a year or two. I may possibly tie it twice, but usually only once. If my vine is strong, it makes laterals all the way up. I cut them back to one or two eyes, never leaving over two, generally not more than one. I always trim it early in the autumn,

just as soon as the leaves have dropped, say the last of November; I do not leave this work until spring. I have never varied from that rule. If trimmed in the spring, the vines will bleed, and if it does not hurt them, I do not care to have them bleed. My posts stand up six and a half feet. I cut the vines off at the top of the posts, and then I do not care if they bend over a little. I have, perhaps, from the bottom to the top, from six to seven and a half or eight feet. I cut back every single year to the second eye. Well, you say, "By and by these spurs get long." Well, I know they do. The increased strength will take them a little further each year. I have one year passed by my crop. I cut them right off smooth, up to the old parent-stem, and made them push a dormant eye. Then I began as I did before. I have vines that are self-supporting, stand right up by themselves, without any posts, two and a half or three inches through. There they stand. I never lay them down, do not do anything to them, except prune them, thin the fruit, and keep the weeds down. You ask, Do they bear well? Generally; this year not so much as last year. It is hard work to get the men to thin them. I cannot get my men to thin them as they should be thinned. It is just so with my pear-trees. I have sometimes told them to pick off every pear they could find on some trees, and still they left enough. I mean to grow about ten pounds of grapes to a large, strong vine, as big as my arm. I have grown twenty pounds, and carried them through. They did not ripen as well as I would like to have them, or as Dr. Fisher ripens his, but they were as ripe as they get them in the market. I have to grow mine in that way. I was told by my friend Strong that I should break down by that system, but I have not yet. Mr. Elliot, of Cleveland, Ohio, who is accustomed to see vineyards, came to my place, and he said "Hyde, I hardly ever saw such a crop. I think I hardly ever saw it equalled." I have never seen it equalled. That was about five years after planting, but, as I say, my vines will average about ten pounds. I have no difficulty in carrying from eight to ten pounds of grapes, if my land is in good condition. I do not use any coarse, unfermented manures. I use ashes, and some phosphates, and stable-manures two or three years old,

largely composted with this stuff they call muck, which I like after it has been exposed to the frosts in heaps for some years. Understand, too, that I labor under great disadvantages. My land has been used ever since I was born for a nursery, and it is not so good for grapes as new land. I prefer land on which grapes have never been grown. I never lay the vines down. I keep the ground free from weeds, pick my grapes when the time comes to pick them, which is usually from the last of September to the first of October. My men go in with a market-box, as they would go in to pick pears, and the grapes are picked and put right into the box, "deaconed" a little,—you know we have to do it nowa-days,—on the top of the box, as they do strawberries, and sent to market, thirty, forty, or fifty pounds in a box; and these grapes average from five and a half to six cents a pound; I believe never but one year less than six, and that was last year. Six to seven cents is a fair average. That is about half what the Doctor's bring, but it is little or no work to grow them.

Now, I am talking about the Concord. I agree with all the Doctor has said with regard to other varieties. I have tried about everything that has come out, and I do not believe I ever made a dollar with any grape except the Concord; that is, by growing the fruit. Not that there are not other and better grapes than the Concord. I have said that I would never eat it. I have eaten some few this year. It is not good enough to suit me. There are other grapes that suit me better; but it is the grape for market. I wish it was a little earlier. I never could keep the Concord for any length of time but it depreciated very much; and I never kept it a week or two but it had a very unpleasant flavor to me. It is a thin-skinned fruit, and you cannot keep a thinskinned fruit very well. It will not keep like the Diana, or some of Rogers' seedlings that are thick-skinned. It is difficult to send to market on that account. Many of them are bruised by the weight, and they are injured somewhat before they get into the provision store, or on to the hotel tables, or other places.

This may be a rough way of growing grapes. I do not claim that it is a scientific way, or anything like the system

which Dr. Fisher practises. All I say is this, that I know they can be grown at a profit in this way, and you can afford to sell them for six cents a pound. My vines, as I have said, will average ten pounds to a vine. I could make them bear twenty-five pounds, but I do not want to do it. It would injure the vines, and I should fail to get much of a crop the next year.

One difficulty is suggested in regard to this method; it is said that we cannot get well-ripened wood. Well, I do. That is the best answer I can make to that objection. When a lateral gets out about a foot and a half or two feet, I pinch it in. I then practise exactly the system that the Doctor does. As soon as it pushes again, I pinch it again,—generally about three times. It depends upon the season. If it is a very dry season, three times; if a wet season, four times. There is my vine; it has nothing to do but ripen wood, and it will ripen wood, if I do not leave too many grapes on it. There are a good many laterals. If you do not want too many, leave but one eye. If you are not afraid of having too many, leave two eyes.

Mr. Slade. Did you ever try to keep Concord grapes?

Mr. Hyde. Yes, sir.

Mr. Slade. In what way?

Mr. Hyde. I have tried them as I have tried others. I keep grapes very good until about Christmas-time, and I often keep them into January. There are two or three ways in which I have kept them. They should be kept cool, as Dr. Fisher says, and sufficiently moist to prevent shrivelling. I put them in layers in boxes like strawberry-boxes, with cotton-batting or something to exclude the air as much as possible, and keep them just as cool as I can, without freezing.

Mr. Everett. It is evident from the totally different plans suggested by yourself and Dr. Fisher, that grapes can be grown by two different methods, certainly, and unquestionably that number might be increased. It has been my pleasure to see the vineyards of California, just after the grape-crop was picked. Three years ago the present month, I travelled over that State, and I went through that remarkable valley, the Napa valley, which has produced more grapes than any other spot of land on the globe to the acre. When

I first saw the vineyards of California, I did not know what they were. I saw, in the first vineyard I came to, a lot of stumps standing about fifteen or eighteen inches high, and about two or three inches through, and on top of them a bunch like my two fists. I said to my son, who was with me at the time, "What is that?" "That is a vineyard." That was, perhaps, a field of some five or six acres, and all that was done in relation to trimming and fertilizing in any way was to cut off the entire growth of wood in the fall, gather it into piles, and burn it, and spread the ashes upon the ground. There the stumps stand until the next spring, when twelve or fifteen shoots start out of this pile at the top of the stump, which grow, perhaps, from three to five feet, loaded, of course, as you never see the vines in Dr. Fisher's or Mr. Hyde's vineyard, with somewhere from twenty to thirty or forty pounds of grapes to each stump, the stumps standing eight or nine feet apart, but some of them very much nearer. As you pass through Calaveras County, you see vineyards of ten, twenty and thirty acres with these stumps standing in this way, growing what is an immensely profitable crop, although the price is not the ten, twelve or fifteen cents a pound which Dr. Fisher obtains, or the six or seven cents a pound which Mr. Hyde gets in Boston; it is only from half a cent to two cents a pound, varying somewhat with the crop, and the use that is to be made of the grapes. There this noblest fruit which God has given us is converted into a curse in the shape of wine, very generally. The year I was there, some two or three millions of gallons were made, I think; this last year, the quantity was ten or twelve millions, and it is constantly increasing. The grape-crop is immense in the vineyards of California.

In relation to the use of the grape, I will say, I doubt not it is the best fruit the Creator has given us; so far, certainly, as its effects on the human system is concerned. There is nothing equal to it. You have undoubtedly heard of the wonderful cures effected by what is called the "grape-cure." They have established in Germany a sort of medical institution, to which invalids resort for the cure of certain diseases, and it operates more directly upon the blood than any other fruit. It is more nutritive and more purifying than any other fruit.

QUESTION. I understood the gentleman to say that these shoots come from stumps fifteen inches high, and that the shoots were some five or six feet long, and sustained from thirty to forty pounds of grapes. I want to ask him whether those shoots support those grapes, or whether they lie on the ground?

Mr. EVERETT. The shoots bend over, and the bunches hang over the stump, and almost touch the ground.

Mr. SLADE. I listened to a discussion some eight or nine years ago, when I first became a member of this Board, in regard to grape-culture. The lecture was delivered by Mr. Bull, of Concord, and a gentleman who came some forty or fifty miles, in common with me, to hear this lecture, with the view of planting a vineyard, became so discouraged during the complications that Mr. Bull went through in trimming the vines, that he was completely disheartened, and finally decided not to set out a vineyard. Now, the object is to simplify the thing, so that anybody who is not very wise can go ahead and have a vineyard of his own. As I came to the hall last evening, a gentleman said to me, "I have got a certain number of vines, I have read everything in regard to pruning, and I am perfectly bewildered. I lay awake nights thinking what I shall do. I want to know how I am going to manage that vineyard." I had been over Mr. Hyde's vineyard, and I told him, "Train the stem right round your stake, tie a string at the top, and cut off the end." "Where?" says he. Says I, "Cut it back until the wood is hard and black. What you want is well-ripened wood." He felt pleased with that advice. What I wish to say is, that there is not a town in the Commonwealth of Massachusetts in which there are not particular spots that are almost worthless for any other purpose, where a vineyard may be planted and cultivated profitably and with pleasure. I went into it in the dark. I have a little vineyard of three or four hundred vines. I began eight or nine years ago. My neighbors, although they encouraged it, rather laughed after I got started. They said, "Well, I guess Slade has got something he will be glad to get out of," and I did not know but I should, too. I selected a gravelly knoll, planted a hedge around it, and cultivated my vines. And here I wish to say

a word or two. In my simplicity at the time, in view of planting this vineyard, I had collected all the old bones I could find in a pile, and was calculating to plant the bones with every grape-vine when I got ready, but the amount of it was, I had only bones enough to put into just one row. My vines this year (which, by the way, are pruned as Mr. Hyde has described) averaged eight pounds to the vine, but the first row, where I planted those bones,—they were old skull and thigh bones, and everything of the kind that I could pick up,—those twenty vines in that row produced three hundred pounds of grapes. That was fifteen pounds to the vine. I have no doubt that if I had planted the bones with the other vines, every other vine would have produced in the same proportion.

Mr. EVERETT. Were those bones uncrushed?

Mr. SLADE. Uncrushed, crude bones, such as you would pick up on the farm.

QUESTION. What did you get a pound?

Mr. SLADE. I got eight cents a pound right through, and a man in Providence, who bought them from the man to whom I sold them, sent me word that they were the best Concord grapes he ever sold in the Providence market. I thin the grapes but very little. I trim on the spur system, as Mr. Hyde does, precisely, as near as I can. I do it very quick. I have a pair of shears and it is not much work. We are troubled with rose-bugs about there, and, as Dr. Fisher says, we meet them when they come, usually in the morning while the dew is on my strawberries. I hire boys, and give them five cents a hundred for all they will kill. That is a standing offer, and I have some half dozen boys who help me in that way. This year, I paid three dollars and seventy-five cents; last year, about half as much; year before last, about twice as much. That is the way it runs with me.

I am in favor of everybody raising grapes. Somebody has said that the grape is the type of plenty, and the symbol of happiness. It is even so. I raise crops which are more profitable than the grape-crop, but I do not raise any which gives me half the pleasure that the grape-crop does. In fact, I do not raise any fruit which I think is half as valuable as

the grape. It is a very luscious fruit, and to me it is the best that I can raise. Strawberries do not begin with it. There is no comparison between strawberries as a fruit and well-ripened Concord grapes.

There is a great deal that might be said upon this subject, but it has already been pretty well aired, and I will not occupy any more time.

Mr. Lewis. I think strawberries are best the fore part of the season, and grapes in the fall. How is that?

Mr. Slade. There is a difference of opinion about that. I would rather have grapes in the fore part of the season. We have made two or three rather unsuccessful efforts to keep grapes along into the winter. We packed them in cotton, and kept them in pretty good condition. I am very anxious to succeed (and that is the reason why I asked the question of Dr. Fisher) in keeping them, so that I can have the fruit all winter. This year, we packed two twenty-five-pound boxes in sawdust, as we would Malaga grapes. Of course, it is not time yet to test them, but we opened a box at the house on Thanksgiving Day, and had a very nice treat. They were in very good condition, and I could not see that they had deteriorated in the least. Perhaps they were a little over-ripe, and those that were over-ripe cracked a little; but, throwing out those, the berries were plump, and answered very well, a good deal better than no grapes. I think the skin of the Concord grape is too thin to keep any great length of time.

MARKET-GARDENING.

About market-gardening, I will say that I do not practise market-gardening. I have a piece of asparagus, a piece of currants, then come grape-vines, strawberries and a piece of onions. The maggot is eating the onions, the beetle is eating the asparagus, the worm is eating the currants, and the rose-bug is eating the grape-vines. I tell you we have just as much as we can do to keep them free, and yet I say here that the pleasure of growing these things would be considerably lessened if there was no trouble about it. I think there is a great deal of pleasure in overcoming these obstacles. I said to Capt. Moore (I do not see him here), after I had

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planted my asparagus, and found what a mistake I had made (I did not know anything about this beetle), "What shall I do? You have got me into it, and I want you to get me out." "Kill them," said he. "How?" "I don't care how, but kill them." That put me upon my own resources, and I went to work to kill them. I put some kerosene into a wash-pan, large at the top, and shook the beetles into it. They did not like it, and I kept them off pretty well with that. The next year, they came on again, and I kept them off until we got into our strawberry business, and then I gave it up. I could not possibly attend to it. I had to give up one or the other. Just as soon as I got through with the strawberries, I set my man at work with a sickle, and he cut the asparagus down close to the ground. It looked like murder, but I had determined to kill them, and after it got nicely dried, I just set fire to it, and I burned the whole thing over. But I discovered while the asparagus was lying in those winrows, and very soon after it was cut, that there were any number of white-breasted swallows sailing over that piece, and they remained there. Two or three days after it was burned, the asparagus came right up, and they staid there during the fall, quite a number of them, evidently showing that they got their living there, and I was very glad to have them stay. Last winter, I made a bird-house, and the tenements were taken right up, and they staid all summer. I did not see a slug on my asparagus all summer. So much for the birds. I am going to build them some more tenements, and rent them free.

Mr. Hyde. Mr. Slade's treatment of those beetles is just the one we adopt for the rose-bugs. We take some kerosene in a dish, and go round and shake them off into that. They do not live long in that kerosene; they do not seem to enjoy it.

One gentleman has spoken about the Early Rose potato. I think they are a very admirable potato, but there is another seedling, which many of you may know, called the "Early Vermont." I have tried that a little, and I will give my experience, for the benefit of those who have not tried it. In the first place, I was quite sure it was the Early Rose, and nothing more. It is impossible for the best judge to detect the difference. I did not have my tubers until the twenty-

second of July. They had been on Mr. Washburn's counter ever since February, and they were so dry you could not tell that they were potatoes by their appearance. I put two pieces in a hill. They were in the ground eighty days, during eight or ten of which it was extremely dry, and they did not start at all; but from those potatoes, which weighed three pounds when I got them, I gathered one hundred and eleven pounds. They did not begin to grow until people were beginning to dig their Early Rose potatoes. It is claimed that it is six or eight days earlier than the Early Rose, and it is claimed to be much more productive. I have heard of crops of four or five hundred bushels to the acre. Those of mine gave, perhaps, at the rate of between three and four hundred bushels to the acre. They were very smooth and handsome. I have formed a very favorable opinion of this Early Vermont. It is evident that it is a seedling of the Early Rose. It is the Early Rose, reproduced with the original productiveness of the Early Rose, for when that first came, it produced far more in quantity, with me, at least, than it does now, though I have changed my seed once, getting it from Vermont.

Mr. Everett. How is the quality, compared with the Early Rose?

Mr. Hyde. I cannot say definitely, because they were grown so late in the season that they were not so good as my Early Rose, planted early in the season, but the texture is almost exactly like the Early Rose, and I am told by Mr. Bliss that the quality is fully equal to the Early Rose.

Mr. Goodale, of Egremont. I have planted the Early Vermont for two years, and my experience has been much the same as that of the President. The first season, I raised about one hundred and sixty-four pounds from one pound; last season, I raised one hundred and sixty-nine pounds from one pound, with ordinary farm culture. I planted single eyes, fifteen inches apart. The quality I found almost exactly the same as the Early Rose. I do not think, as the President says, they can be distinguished from the Early Rose. Practically I think it is no earlier than the Early Rose. Perhaps the vines die a few days sooner, but I think that really it is not any earlier. It is undoubtedly a seedling from the Early Rose. I am satisfied of that.

The CHAIRMAN. Has it any advantage over the Early Rose?

Mr. GOODALE. Possibly, in the yield. With me, they have yielded better than the Early Rose, the last two years, with the same treatment. I have also tried this year the "Compton Surprise," which was originated by Mr. Compton, of New Jersey, and I find it an exceedingly prolific potato, rather coarse, and requiring the full season to mature. It was sent out as an early potato. That was a great mistake. It requires the full season. I dug mine the tenth of October, and they were then hardly ripe. I got from one pound, with ordinary farm culture, three hundred and nineteen and three-fourths pounds,—about five and one-third bushels. The hills were three feet apart, a single eye to the hill. This was, of course, without slipping or forcing, in any way. It is full of eyes. The objection to the Compton Surprise, as it strikes me, is, that it has very deep eyes, and its color, a dull red, is against it; and in growth, it spreads over the whole ground. You have to dig over the whole of the ground to get all of the potatoes.

QUESTION. What shape are the potatoes?

Mr. GOODALE. The potatoes are round, or nearly round. I have not fairly tested the table quality.

The CHAIRMAN. Do you think any man can raise six hundred pounds from one pound?

Mr. GOODALE. I do not doubt it in the least, with this Compton Surprise, and with ordinary culture. In my own case, I was satisfied that I should have got nearly twice as many, if I had had good success in keeping the mice off. They infested every hill, and some of the hills they had eaten out the inside of all the potatoes, simply leaving the shell. I got from one hill twelve pounds of potatoes, from one eye.

Mr. EVERETT. I think that is the most wonderful statement that I have heard yet. The gentleman states that he got twelve pounds from an eye, three hundred and nineteen pounds from one pound. That certainly beats anything I ever heard of in relation to the growth of any tuber.

Mr. GOODALE. I would state that that yield has been very much exceeded, as Mr. Hyde has remarked. I think those potatoes were sent out to twenty-eight different States.

There were several competitors for the premium of one hundred dollars which Mr. Bliss offered for the largest yield from a single pound, with ordinary farm culture. I would state, that there were twelve which exceeded my yield with the Compton Surprise.

QUESTION. What do you consider "ordinary farm culture"? It seems to me that is a pretty important thing for us to understand.

Mr. GOODALE. By "ordinary farm culture," I mean simply an avoidance of slipping or sprouting. It is perfectly well known, that immense crops of potatoes can be raised, by cutting the sprouts off and dividing them into small pieces. I mean, planting them, and manuring them as we usually manure and plant for a farm crop, one eye in a hill. That has been my practice for some years. If I use barnyard manure, I always spread it the previous year. I usually put a compost into the hill. The compost that I use is composed of charcoal dust, say two parts bone, or bone flour, or bone meal one part, and sometimes ashes and plaster also.

QUESTION. That you use instead of the shovelful of manure which common farmers use, I suppose?

Mr. GOODALE. Yes, sir.

Mr. SLADE. Do you plough it in in the fall, or leave it on the surface?

Mr. GOODALE. I usually harrow it in in the fall.

QUESTION. How many hills did you make from this one pound of potatoes?

Mr. GOODALE. I believe I had about seventy eyes. The gentleman seems to be surprised. I bought one pound of Early Rose, which consisted of four potatoes. I waited a a few days until they had started, so that I could see every eye, and I made one hundred hills out of that pound, without any slipping or sprouting, any further than this: You have noticed that where there is one large eye, there will sometimes be quite a cluster of sprouts. I took a long, sharp knife and divided that cluster nicely, so that I made sometimes five hills out of a cluster. Some of the pieces would be no bigger than a kernal of corn. I put the pieces very carefully in the ground, with the eye up, and that eye produced as much as any of the others. I raised one barrel

heaping full of potatoes from that one pound. The next year, I believe I planted an acre with that barrel. At the time of planting, some of them had sprouts two inches long. Those sprouts naturally fell off. I told some of my men to save them, and I set some of them in my garden, as nicely as I would a cabbage-plant. They all grew, and I raised five bushels. I might have raised twenty bushels if my man had set them out as I told him to. He set them out, and covered them as you would a row of pease.

Mr. Slade. Has Mr. Goodale noticed any difference between the result in planting his seed from the eye-end, the butt-end or the middle?

Mr. Goodale. I never have carried on any experiments in selecting. I use the middle, the eye-end and the butt-end.

Mr. Stone. I wish to ask my friend Lewis if he can relate any experience in New York State? I think he can tell us something about raising potatoes.

Mr. Lewis. I hardly know what to say, gentlemen. I think that since the people of this Commonwealth have become such great bores, they can bear bigger stories than they used to. I think we should not have heard these big stories about the yield of potatoes, if it had not been for the Tunnel, but still it may not make any difference. I understand that Mr. Stone wants me to repeat what I said last winter, I believe, in regard to fertilizing some beets. I tried some experiments with hen-manure. I have used it for twenty-seven years on root-crops, in every conceivable way, and on one occasion I mixed a bushel of hen-manure with nine bushels, I think, of muck, and I used this on my beet-crop, and estimated that I got ten tons for a bushel of hen-manure. Now, this will beat all your potato yields, and the Tunnel, too.

I have been using some of the refuse salt from the salt-works at Syracuse, this year, and I think that for every four or five bushels sown, I have got ten additional tons of beets. I have sown about four or five bushels per acre of this refuse salt, and as near as I can estimate, the difference between the crop where it was sown and where it was not sown, it has given me just about ten tons per acre. It is wonderful. I

do not know that it would ever do it again. I never have been able to come up to the hen-manure scratch, by more than half, except that one time. Everything seemed to work in favor of that. The weather was peculiarly favorable; the condition of the crop was just right to apply it, and I have never had all these favorable influences, with the hen-manure mixed in, since. I may never succeed again with these salt-washings as a special manure for the root-crop as I have this season, yet I tried a little last year, and it worked wonders, certainly, on the root-crop, and I have come to believe that salt is a special fertilizer for the mangold, the cabbage, the whole turnip family, the whole cabbage family, the whole beet family, and I do not think it can be beat by anything, for beets, except hen-manure. These salt-washings are taken out of the factory filled salt that they manufacture there. It is passed in some way through water by something resembling an elevator in a flouring-mill; I do not understand just how it is done, because I have never seen it. They tried to describe the process to me, but I am so thick-headed that I could not fully comprehend it; but they run it through water, and it takes out this refuse salt. It is composed of 34.304 per cent. of chloride of sodium (that is, common salt); 35.749 per cent. sulphate of lime, or plaster of paris; 9.039 per cent. of carbonate of lime; 1.605 per cent. carbonate of magnesia. This carbonate of lime they use in the brine to free it from its impurities. It has 0.206 per cent. of insoluble matter, 0.497 per cent. of organic matter, and about eighteen per cent. of water, or loss. I find that I can dry out about eighteen per cent. of it, and that, I conclude, is water. Now, gentlemen, you see that, for any aquatic plant, such as celery, the whole cabbage family, the whole turnip family, this is a grand fertilizer, and I would say to the farmers of Massachusetts, that I have agreed to take this salt, and use it upon every kind of soil, and I have obtained two or three assistants to try it in different localities, and you shall hear the result; but I believe it will pay the farmers in any section of the country to obtain this salt. It costs, at the works, about three dollars and a half a ton, put up in soda casks, which hold from five to seven hundred pounds each, and it can be cheaply brought to you; I think so cheaply, that you will

find it the cheapest fertilizer, for some crops that you grow, of anything that you can get.

QUESTION. Was the salt harrowed in or ploughed in?

MR. LEWIS. It was sown after the beets had put out the fourth leaf. The ground was cultivated two or three times afterwards, but it lodged everywhere on the beet-tops. It was a dry season, very dry; well, "dry" does not explain our condition the past year in the county of Herkimer. We were burned up, broiled, fried, roasted, stewed, without any water to stew us in. Now, in a season like this I apprehend salt did twice as much as it would do in an ordinary season. And yet there is this peculiarity about using salt as a fertilizer, you can use double the quantity in a wet season that you can in a dry, because, if you get on too much in a wet season, away it goes out of sight and out of hearing. It goes right down into the earth.

MR. SLADE. Could they supply large quantities of this salt?

MR. LEWIS. Oh, yes, sir. I think the salt companies there would be benefited by disposing of it, and the farmers would be benefited by taking it away.

QUESTION. How many tons of beets did you raise to the acre, when you used the hen-manure?

MR. LEWIS. That year I raised forty-four tons to the acre.

QUESTION. Would our common commercial salt and plaster have the same effect as this article of which you speak?

MR. LEWIS. I cannot tell, because I never tried the experiment, but I can see no reason why it would not.

QUESTION. Would a fertilizer made from the analysis you have stated work the same, provided this salt cannot be obtained?

MR. LEWIS. I do not know why it should not.

QUESTION. How was the hen-manure applied,—was it spread or harrowed in?

MR. LEWIS. It was dropped right at the root of each plant. It has to be put on carefully.

MR. CARTER. I simply manured my beets with barnyard manure, made by the cows in summer. I applied it in the fall, and ploughed it in. In the spring I ploughed it again, harrowed it, smoothed it, and then turned two furrows to-

gether, and back-furrowed it into ridges, three and a half feet apart,—far enough apart to go through with a horse-hoe,—and sowed my beets on the top of those ridges, endeavoring to sow them so that they should not be nearer than six or eight inches, but they were nearer than that, and we thinned them out. They were cultivated thoroughly with a horse-hoe. I raised a little more than forty tons to the acre, or at that rate, as reported by a committee, the average rate being taken.

The CHAIRMAN. What variety of beets were they?

Mr. CARTER. The mangold-wurzel, the red beet.

Mr. SESSIONS. Is salt beneficial to asparagus?

Mr. SLADE. I am not competent to answer that question. It is customary to apply salt to asparagus, and as near as I can find out, the reason it is thought to be necessary is because asparagus, although not exactly a marine plant, is found growing on the marshes, and on beaches near salt water, and people have been in a hurry to draw the inference that it needed salt in order to flourish. Now, I find it growing near beaches, and I find it growing in the woods, where there is a beach opening, on light soil. The seed is evidently distributed about by the birds, and in other ways, and it seems to me that the idea that it needs salt is an erroneous one. I have put a couple of barrels of salt on half an acre every spring, and I do it because I think it will keep the weeds down. That is all I did it for. It certainly lowers the temperature, and the asparagus is a few days backward, and for that reason, I have thought I would not apply any next year, but I am going to send and get a ton of that salt from Syracuse. The reason why I am going to abandon the use of salt on my asparagus is because, from the little experience I have had, it does more harm than good, in this way: It lowers the temperature, and the asparagus will be two days behind, which is of considerable consequence with that crop, and I would rather have the asparagus two days earlier, even if I have the weeds which the application of salt is supposed to prevent.

The CHAIRMAN. A few years ago, I was at Concord and saw an asparagus-bed, owned by a friend of mine. There was not a weed to be seen of any size on his bed, and it

looked almost as though it had been burned over. I asked him the cause, and he said it had been salted so that no living thing could grow there except asparagus; but his asparagus was only the ordinary growth. I have used salt every year, and I cannot see that it does any good, except in keeping down the weeds. It will keep them down; but on my soil, I cannot see the slightest advantage to be gained from the use of salt on asparagus.

Mr. SESSIONS. I put that same question to Capt. Moore this forenoon, and he said it did no good whatever. He had tried it time and again, and was satisfied that the thing was without foundation, from the fact that he had a bed to which he had never applied any salt, and the asparagus picked from that bed always took the premiums at horticultural fairs.

Mr. EVERETT. I have an asparagus-bed on my farm that was planted from one hundred and eighteen to one hundred and twenty years ago, by an old English officer. It is about ten feet by six or eight. I have applied salt to it since I have had the care of it, and I never could see any result upon the asparagus, except that it killed everything else, and therefore, in that indirect way, may have benefited the asparagus.

Adjourned to evening.

EVENING SESSION.

The meeting opened at 7½ o'clock, and a lecture was delivered on

THE DEMANDS OF AGRICULTURE ON VETERINARY SCIENCE, AND THE MEANS OF ITS ACCOMPLISHMENT.

BY PROF. NOAH CRESSY, OF THE MASS. AGRICULTURAL COLLEGE.

Mr. Chairman, Ladies and Gentlemen:—It affords me pleasure to be thus called home to my native State, and to have the honor of addressing you on this occasion; for my heart has long been in sympathy with your progressive movements in the noble cause of science. And though I am, comparatively speaking, a stranger to most of you, yet this cordial welcome to the Old Bay State again, gives me courage

and consolation, as I assume the duties which you have assigned me.

There are many things over which you must rejoice to-day. Your ardent labors have been attended with success; and there is a gratification in knowing that other States have followed your example in this work of rural culture. Your Board of Agriculture have now grown to manhood and renown under the spur of the scintillations from the sturdy Flint within your hands. And hence new issues, at this age, must inevitably arise, the same as in our social, and much oftener in our political life.

In reviewing the history of education, with the rise and progress of science, we find that all branches have not started into existence on the same influence, nor from similar causes. But the demand of an age has often been shaped by the simple requirements in the rural world, or in the industrial arts. Chemistry affords a marked illustration, in the diffusion of useful knowledge, which has followed since this science emerged from the thraldom of alchemy. It now holds a prominent place in our educational system, and has become the fostering handmaid of every branch of human industry throughout the world. And the same is true, in a great measure, with the other collateral branches of agriculture.

Thus in our educational movements we are passing through our age of transition. The old classic system of instruction, which for centuries has held its sway, and has been regarded as the essential element of discipline, is now gradually giving way for the dawn of a new era in the march of science. The establishment of our agricultural colleges, throughout the land, was but the voice of this onward movement in behalf of practical education. Our farmers have long desired that their sons should be educated in all those branches which pertain to the routine of their daily toil. These new institutions were therefore specially wanted, to thus train the minds of our youth for an agricultural calling; and hence these colleges should receive the united sympathy and support of every cultivator of the soil. Such practical schools must inevitably open new avenues for scientific investigations in this country, and thus afford ample facilities for mental discipline.

But it is not my purpose, this evening, to speak in general terms of an agricultural education. There is another department connected with your calling, which in view of the growing live-stock interest in America, and the inevitable consequences of such traffic upon the public health, deserves our most thoughtful consideration.

Veterinary Science will therefore be our theme for the present hour. And in order that we may fully comprehend the scope of this important branch of knowledge, let us define its boundaries, and thus see the relations which it holds to other departments of learning in a practical point of view. The veterinary calling presents a broad field for study and observation. It comprehends anatomy, physiology and pathology, as well as the general principles of practice; and thus in its scientific aspect, is coëxtensive with that of human medicine. In fact it should be ranked, by general consent, as a sister profession of the Healing Art, and therefore guarded and cherished with a jealous care by every physician in the land. The age demands that the veterinary art should receive encouragement from our public institutions, and henceforth enjoy an honorable recognition, at least among the learned professions.

But it is a lamentable fact that this calling has been, to a great extent in this country, confined to the uneducated and pretentious. And the public are alone to blame for such a state of affairs. Men with no previous knowledge of the causes of disease, nor of the physiological actions of medicine, have suddenly been born anew, as it were, in the veterinary department of our noble healing art. Many there are, in our community, who have already amassed a fortune by such pretentious practice; and still they have the favor of public patronage, and the reason why the medical profession at large have always been so uncourteous and distant in their intercourse with the veterinary doctors, so called, is the fact that so few of them are educated, and worthy a strict professional acquaintance. Besides, such men usually follow set prescriptions, good or bad, as the case may be, in their practice, and thus, without discrimination, they often administer the same kind of a "dose" for a great variety of affections. Of course these remarks do not apply to the few regularly

educated veterinarians in this country. But there is quackery enough at best in all professions. But when the majority of men in a given calling shall assume to have been taught the "secret of success" by intuition, and the people financially sanction the same by their patronage, there is something wrong in the condition of the public mind. The light of science has not yet penetrated every superstitious nook of American society; and hence we not infrequently hear of natural-born "bone-setters" and "horse-doctors" who claim a knowledge of their business far transcending that of our best educated men.

With such a condition of things we cannot expect much progress in the veterinary art. Nor shall we ever see any good results from this calling until the public demand reform, and thus require a more faithful adherence to the principles of physiological science in the course of preparation for this kind of practice. And here I will say, without fear of contradiction in this or any other intelligent audience, that he who deems himself competent, without previous study, to administer to the wants of our domestic animals, when stricken with disease of any kind, is equally well fitted to assume the responsibility of administering to his own beloved family. For we should remember that all these creatures, as well as man himself, in point of structure, are "fearfully and wonderfully made," and should therefore be treated with the same thoughtful attention and care that belong to human practice.

On this basis veterinary medicine becomes an honorable calling, and ever worthy of our esteem. But strange to say, there are physicians among us who ignore and criticise our efforts to popularize this branch of the healing art. Some have treated us with not a little contempt for having turned our attention in this direction. Others have lauded our efforts and have given us a helping-hand in our investigations; for they have seen the folly of intrusting our pets and valuable animals to the hazardous experiments of the ignorant. This was practically demonstrated during the progress of the late epizoötic, as men of all types and of different degrees of intelligence suddenly became renowned in the treatment of this equine malady; but since its decline they have not been

heard from, I am happy to say, nor shall we ever expect to meet them on the medical arena again, unless we receive another visitation of this same calamity.

From this you perceive the necessity for the public encouragement of veterinary science. Your attention was practically called to this subject a year ago by the sudden invasion of that equine pestilence. As it came upon us so unawares we were not prepared, professionally, to battle with such a scourge. And as this plague swept over the country, like its allied forms in the middle ages, the medico-veterinary wisdom of the nation could but humbly bow at the geographical magnitude, and unparalleled severity within historic time, at least upon our virgin soil.

We saw in this calamity only the financial phase of our dependence on the lower orders of animals for comfort and support. But what would have been our condition had this disease involved our neat stock, sheep and swine, or our poultry, as it was falsely rumored, in the same putrid, fever-like form? Yea, a panic-stricken dearth would inevitably have followed; for we are dependent upon the flocks and herds of this latitude for many articles of our wearing-apparel, besides the animal products of our daily food. Suffering and death would then have followed in an untold degree. Thousands upon thousands of our puny children must then have died for want of food. All the milk would have been diseased and thus unfit for human use.

I ask, therefore, in view of such a scene, if the veterinary art is unworthy of our attention? Can we possibly spend our time in a more useful and important field of labor than to search for the causes of all such dreadful maladies? We have thus been forcibly admonished of our unjust appreciation of the equine race in all of our domestic and commercial relations of life, and of our negligence in regard to the care of this noble animal. And hence we trust that the severity of this epizoötic malady will long be remembered by our people, and thus awaken a renewed interest in behalf of veterinary education.

Again, there are various forms of contagious and malignant diseases to contend with among the other domesticated animals. All of these maladies affect our meat-producing crea-

tures to an alarming extent; so much so, that the public health is already involved and henceforth it will require stringent measures to protect the same. And unless we have a competent veterinary inspector in every State, authorized by the legislature, to examine all such diseased animals and report the same to the proper authorities, there will soon be no safety in the consumption of animal food. For every year brings some new disease to light, which may perhaps greatly affect the public purse in the losses by death, as well as deprive our tables of meat and milk, if not investigated and controlled. All this important work must be done by the veterinarian in behalf of science, for the majority of medical men are seemingly above such practice. And yet many of the diseases to which your physician may be called might have been prevented were the principles of veterinary science more generally understood. Hence, are there not motives for every one of you to foster this important calling? You may, individually, feel unconcerned about this matter, but the public demand a change in the general system of education, in order that this department of learning may not longer be overlooked, either in a sanitary or financial point of view.

The farmers must be the pioneers in this great movement. And as you control our immense live-stock traffic, you should be the most interested in its welfare and in the healthful condition of all those creatures especially, that are intended for our animal sustenance. The live-stock interest of our country, therefore, demands our aid for self-protection in time of need. And thus for our mutual benefit we hope for encouragement and success in this new province of investigation, which cannot fail to interest our intelligent people when they fully comprehend its utility, and thus see its relations to human happiness and prosperity.

It therefore behooves us in behalf of American agriculture and the interests of the public health, to call the attention of our people to the amount of diseased meat which is wilfully bought and sold in many of our large city markets. During the prevalence of pleuro-pneumonia in New Jersey, last winter, more than five hundred sick creatures were slaughtered and sold for human food. So great was this traffic in "cheap

beef" that the board of agriculture of that State memorialized the legislature to appoint a committee with full authority to investigate this whole matter, and prosecute all offending parties. But through an oversight in law-making, two opposing Acts were placed upon the statute books, and hence nothing has been done there to curtail these infamous transactions.

This diseased-meat traffic is comparatively new business for the American people, but such fraudulent speculation has been practised in the old country for many years. Animals that have died from various forms of disease have been dressed and disposed of among the poor as a *cheaper* class of beef. And during a siege of war or a famine, this trade has often increased to such an extent that a plague among those suffering mortals has been the inevitable consequence. Hence, is there no cause for alarm in this direction, or shall we sleep, as it were, with perfect confidence in each other, when the meat-trade affords the most glaring opportunities for dishonest practice? And this is simply because the people have not been educated in this sanitary branch of knowledge, as the age demands. I have no desire to offend the butcher, nor to vitiate the appetite of the faint-hearted or the dainty; but I do desire to have our people know the sources from whence much of their so-called *cheap beef* comes. I have known of butchers offering *half* price for a sick animal, on the ground that it could be doctored and saved; but I fear that such creatures never get any other treatment than a finishing blow when bought for such a purpose.

There are various diseases that affect our meat animals, and thus render their flesh unsuitable for human food. All, in fact, are dangerous, but some more so than others. And the consequences of thus consuming any of this diseased meat should awaken a deep interest among the guardians of the public health. For we find that *malignant pustule* and other forms of carbuncular fever are on the increase from year to year. This is clearly shown by statistics from London and other large cities. And the register-general of Scotland has called the attention of that people to this same subject. Shall we not therefore make some move to warn the people of our State against the traffic in such vitiated food? I need no

reply. You all feel the need of it. But how shall it be done, and who shall take this important work in hand? The public must assume the responsibility, and thus control the matter. And as you encourage this veterinary calling, you will contribute to the improvement of the sanitary condition of live-stock throughout the land; and thus confer a lasting blessing upon humanity as the result of your labors in such a noble cause.

But the demands of agriculture on veterinary science are important to the farmer in more than one point of view. Financially considered, this calling is indispensable to the welfare of every live-stock man in the country, when fully considered in all its relations. There is a pressing need in our community for more accurate knowledge on all the diseases of domestic animals; and it is surprising to see how little attention is paid to this subject, by those who are familiar with the general progress of knowledge in other avocations of life. You will often see the manufacturer watching the movements of his ten thousand spindles, and employing the best talent of the age to keep them in repair, and yet he will allow his horse, which is almost as precious to him as his family, to be doctored, and perhaps by one of the most ignorant men in the town. And whatever may be the result, the owner is sure to be satisfied; for this horse-doctor, so called, has the reputation of being able to give the creature "something that will be good for whatever ails him," no matter what that may be. No questions are asked; for the dose is a secret, but is said to perform most wonderful cures.

With this criterion before us, do you wonder that veterinary science is so unpopular with the masses of the people? For were it otherwise the "cow-doctor" would not see a clear case of horn-ail in every sick creature to which he might be called. Yet few can imagine how very prevalent this so-called disease has been, and with what unerring certainty, as they claim, it has been cured by a drench of salt and vinegar or soft-soap, turpentine and black pepper poured into the ears, and also into the horns through a gimlet-hole in the same. I need not tell you that this affection exists entirely in the mind of such a practitioner, but never in the creature's horn. And so it is with various other imaginary affections for which

our cattle are frequently doctored by those whose ignorance is only measured by the *materia medica* which they employ. It is not a little surprising in this age of medical improvement, that men will allow their sick animals to be treated with almost every conceivable nostrum, though worthless, filthy, and even unheard of in the dark ages of the healing art.

Thus it behooves us to nurture this important calling on every hand; for we know not how soon some foreign plague may actually be implanted upon our unguarded shores. You have seen the havoc which pleuro-pneumonia produces in a farming community. And no language of mine can forestall the importance, or thus more vividly impress upon your minds the absolute necessity of enforcing strict quarantine regulations to curtail the invasion of the same when it appears in the epizoötic form. For you have had a sad and tedious experience on different occasions in trying to extirpate this bovine pestilence. From its first introduction here, in 1842, we have never been entirely free from its local outbreaks; and the ravages of this disease in the aggregate have already caused an immense sacrifice of live-stock property. It still exists, and as its latent germs are now very widely sown, we frequently see its local manifestations in various parts of the country. And, as its period of incubation is so uncertain, there are fears of its becoming naturalized, as it were, upon our virgin soil. This perhaps may serve to explain why it breaks out upon us so unawares, and thus becomes so difficult to eradicate or control. Hence, you see the importance of educating our people in the principles of veterinary science, that we may be prepared to baffle this contagious malady whenever it may occur.

But there are other diseases of the bovine race of far more malignant character, among which we would mention charbon, splenic apoplexy and milk fever, so called. The first is quite prevalent, and is known, professionally, as carbuncular erysipelas or "blackleg," in common parlance. In this whole class of anthrax diseases there is a septic poison, though not strictly speaking, contagious, but which if inoculated into the blood of man, either directly from the meat or from eating the same in a comparatively raw state, produces a fearful malady, know as malignant pustule, which we have before

referred to, and which is usually fatal. A modified form of this disease may occur from eating other kinds of diseased meat. In fact, all the carnivorous animals suffer the same consequences from such a diet. A man in Connecticut recently lost five cats from eating the flesh from one of these creatures that had died of charbon only a few hours previous. The skin had been removed when I saw it, but I admonished him sharply for so doing, and told him never to repeat the experiment, but to bury such a carcass at once. He failed to do so in this case, and though the man escaped inoculation, yet his pet cats and the neighboring dogs consequently suffered the pangs of death. The majority of deaths from this whole class of diseases are very sudden, and often without a noticeable premonition. In such cases we are very liable to slaughter a veal calf in that critical moment, when, if it had not been killed, it might have died a few hours later from this insidious malady. This perhaps may account for the sudden and mysterious sickness which not unfrequently follows a dinner of roast veal. And cases are not wanting where even death has occurred from eating such diseased meat, which was supposed to be perfectly harmless, but which on being fed to cats and dogs, by way of experiment, produced the same result.

I need not multiply instances to show the necessity for the diffusion of veterinary knowledge among the people. But this end can never be attained until our public institutions shall teach the same as a regular branch of instruction. I do not wish to be understood that I would turn all of our colleges in the land into veterinary schools, and thus flood the world with doctors; but I do most emphatically urge that our agricultural colleges shall teach the general principles of veterinary science, and thus take a front rank in our educational advancement. This age of progressive agriculture demands that we should instruct our pupils in every department of rural economy; and therefore the veterinary art cannot longer be neglected. It should be a prominent feature in our agricultural education, and thus afford every youth in the land who intends to become a farmer an opportunity to acquaint himself with the general principles of the veterinary art. We are in want of more such men in this

department; and in fact we need a competent veterinary inspector at every port to examine the condition of foreign stock, lest we get the foot-and-mouth disease again, or the Russian cattle plague silently introduced among our native herds.

Another important matter which veterinary science should take cognizance of is the cruelty to our domestic animals. We are taught that a merciful man will have mercy on his beast; and yet how frequently is this injunction disregarded. There are thousands of horses in our cities that are suffering excruciating pain at every step they take; but still they are kept constantly at work to earn a few more paltry dollars for their avaricious owners. These pitiable creatures may be afflicted with an obstinate case of ring-bone, splint or spavin; and nevertheless, without a show of mercy, they are urged on to their daily toil. Neither rest nor treatment is afforded them, simply because the owner claims to be a poor man and to have no money to pay the doctor. And so the creature drags out a miserable existence from year to year. Now this is all wrong. The public should interfere, and arrest such barbarous management of these faithful animals which a kind Providence has given us for our comfort and happiness. But so long as the veterinary art is at such a low state of popularity, and the majority of practice done by men who know not even the first principles of the science, how can you expect reform? You must first educate the people, and then such abusive treatment will fade away.

Again, the railroad management of our beef cattle is far behind this age of improvement. The cruel thirst which the Western stock is obliged to suffer in being brought to our markets is enough to make us loathe the very meat we eat; for often they have been so long without drink that the system is in a feverish state, and thus unfit for human use when slaughtered and sold. And many times, the creatures which have died under such management while on their way, have been dressed and peddled out for healthy food. Veterinary science therefore becomes a sanitary measure for the public good; and our cattle-markets should be under the inspection of competent authority in order that no such diseased meat may ever come to our tables. This subject should come officially

before the State Board of Health, and receive encouragement from all the friends of agriculture, as it already has from that little band of noble-hearted men who have formed a society for the prevention of cruelty to animals. May they succeed in this new field of labor, and thus in behalf of the sanitary condition of our public markets and the demands of agriculture, may they coöperate with the members of this honored Board in elevating the standard of veterinary medicine.

Having thus briefly glanced at the aims and merits of our theme, let us pass to consider the means which are necessary to accomplish such an end. And as you are the chosen guardians of that state institution to which I have had the honor to be called in this department, I desire to lay before you on this occasion some general principles of the science that will enable you to comprehend the scope which I now have in view; and also to make a few suggestions that may seem necessary in the future management of the same. I am not unmindful of the responsibility which rests on me, and the great anxiety that the public feel in thus organizing a new line of study in this important though much neglected branch of science. But I can only fulfil my mission there by the hearty coöperation of the farmers throughout the State, and hence I desire a free expression of opinions, in order that we may arrive at the most improved methods of teaching, and the best plan for the establishment of such a school.

We shall not attempt to graduate students for this calling in our regular course of instruction; but shall endeavor to give them the outlines of the subject, so that they can complete the same in a post-graduate course of one scholastic year of special study. Then I would suggest that we confer upon all meritorious students who pass the final examination, the degree of D. V. M., which in plain English would imply a doctor of veterinary medicine. I object to the degree of V. S., on the ground that no medical man, however gifted in surgery, ever had a degree that gave him such a title. And as the majority of veterinary practice is rather medical than surgical, I should much prefer the one before mentioned to that of veterinary surgeon, even though usage might sanction the latter. And yet, when speaking of one who was skilled in such operations, it would be in good taste to allude to him

in that capacity, as a *surgeon*, the same as we should speak of one in the medical profession under similar circumstances. This would serve to unite in harmony the two departments of the healing art, and thus promote a mutual growth and friendship.

In this connection I desire to explain the true professional relations between the medical and the veterinary men. The regular veterinarian is as jealous of the human practitioner, even those of the old school, as either of them is of irregular members or quacks. And, on the other hand, the medical man has no professional confidence in the veterinary doctor. Now, why should this state of things exist, if both are qualified for their respective callings? There must be something wrong; and hence, I am persuaded to interfere, and thus offer a few words of reconciliation. First, both are wrong on the fundamental principle; for both have studied special anatomy only; the one, that of man, and the other usually that of the horse. They have not looked upon their subjects as having morphological relations to each other, or as even belonging to the same great class of vertebrate animals. Each has been studied in a special point of view, and this is necessary, so far as surgery is concerned. But both schools should have a broader basis, and thus study the general principles of comparative anatomy as preparatory for their special work. Then both would comprehend each other, and thus respect their separate callings.

The degree of doctor of medicine entitles one to prescribe for any creature in existence that may need the service of the healing art, no matter how many such professions may be created. But of course, before he attempted to practice, he should turn his attention to the anatomy of his peculiar species, all of which he has a right to do without being interfered with by the veterinary graduate. And the same is true when the case is reversed; for the veterinarian who has thus studied the descriptive anatomy of more than one species of mammals, is really better prepared to comprehend the structure of man than those who have never studied anything below him.

Such are my views of the mutual relations of these two callings; and therefore, I shall endeavor to lay a broad

foundation for the superstructure of either branch, according to the inclination of the student. In our course of instruction we shall not only study the natural history of our domesticated animals, but carefully inquire into the habits and geographical distribution of every creature that is serviceable to man, whether used as food, for medicine or in the mechanic arts. Hence, the oyster, the lobster and the whale, as well as the Spanish flies and musk deer, would come within the province of our zoölogical investigations; and also their diseases, which possibly might limit the commercial supply. Veterinary zoölogy will therefore be a new and interesting branch of study in our State Agricultural College; for it is important that we should know more about the natural history of all these useful animals. And hence, by this course we shall comprehend a general survey of the animal kingdom, and not confine our investigations to a single species, as the medical men have done.

This general knowledge of zoölogy would enable us to study the parasitic affections with much more zeal and success than has usually attended such labors. There is need of special investigations on this subject, for we have but few physicians in the land who have really studied into the pathology of this class of diseases. And yet the ravages from these parasites are very extensive and troublesome, both in man and domestic animals. No one seems to care about inquiring into these loathsome maladies; for they have been regarded by many as unworthy of their attention in a scientific point of view. In fact, so little is known concerning the natural history of the entozoa among live-stock men, or even by the majority of veterinarians, that really more harm has frequently been done by their prescriptions than would have resulted from the natural course of the malady. Hence the necessity of educating our students in this department of zoölogy as the ground-work for this kind of veterinary practice. The public health may be involved from eating the flesh of animals that are affected by some of these lowly parasites. Pork is often contaminated by the *Trichina spiralis* and thus rendered dangerous for human food; for this entozoön is frequently transmitted to man, by eating such flesh in a raw state, or partially cooked, when

death not unfrequently follows. And no doubt many such cases have baffled the skill of the physician, and have been treated as typhoid fever, rheumatism and various other affections. This subject therefore becomes an open field for study and original observation; for our medical books and veterinary manuals are incomplete, and many of them far behind the age of scientific advancement, especially in relation to the origin of some of these parasites. The naturalists know far more about these worms than the doctors, even though the latter make many attempts to cure. But Dr. T. S. Cobbold, of the Royal Veterinary College, has done more to awaken an interest concerning the verminous complaints, both in a medical and sanitary point of view, than any other professional man at home or abroad. He has contributed largely on this subject both to the scientific and popular journals, and has published in his "Introduction to Helminthology," a complete history and description of many of the internal parasites of man and the lower orders of animals. And he has recently issued a small manual for the veterinary student, which we shall adopt as a text-book, and shall require an examination in the same, at the close of the senior year. There are many very interesting features connected with these helminthological investigations, which are no less important to the physician, than they are to the veterinarian and the farmer, in a practical point of view. Our poultry for many years have been affected by the "gapes," which disease is caused by the presence of a little worm, known as the *Sclerostoma syngamus* in the windpipe and bronchial tubes. This parasite frequently produces great havoc, in many places, especially on old farms. It was first observed by Prof. Andrew Wiesenthal, of Baltimore, in 1797, and by George Montague, F. L. S., in 1808. Since that time, very little has been done about that matter, until Prof. Cobbold called the attention of the English people to this important subject. The sheep are afflicted by a similar worm, which has been called according to its shape, the *Strongylus filaria*, or the round throat-worm. It produces serious results when a flock becomes contaminated with this noxious parasite.

More investigations are needed in this direction; for only a year ago I found, to the astonishment of many keen

observers, that this bronchial affection of American sheep was due in many instances to the presence of this living worm, the same as in the old country, where it has produced such serious losses for many years. It was probably first observed in this country by Prof. Jeffries Wyman of Cambridge, as early as 1840. And it has been frequently seen by President Bustead, of the N. Y. Veterinary College, in specimens of sheep's lungs sent him for examination. But no one was aware of its extensive prevalence until last winter, when the subject was brought to light in the flock belonging to H. L. Stewart, of Middle Haddam, Connecticut; for Prof. James Law, of Cornell University, who was familiar with this disease in Europe, says, in 1871, that he has been able to find no proof of its existence among our sheep.

Hence, can we teach a more important branch in our agricultural schools than that of veterinary zoölogy in all its relations, which will thus include, not only the beasts of burden and the food-animals, but their accompanying parasites? I have therefore dwelt on this subject, in order to call your attention to the merit which it deserves, and will receive in our hands, with your permission and assistance.

In our course of investigations, we shall find excellent opportunity for the study of philosophical anatomy as an element of discipline; and thus we shall be led, from the pure love of science, to inquire into the comparative relations of man with the lower orders of animals. Not that we expect to find the connecting link, which many have imagined, but to see the variations of that plan of structure which thus connects all vertebrate animals. And we shall find, upon careful investigation, that all these creatures can be reduced, morphologically, to a series of transverse segments. Having thus studied the anatomical elements of one of these vertebral segments in detail, we readily comprehend a multiple of each and every animal of this type of organization, with man included.

Again, the human hand, which presents so many points of utility and admiration for the speculations of the philosopher, can be better understood by studying the modified expressions of the same in our domesticated animals. The hog presents the same number of bones in one of the forward

feet, that is found in the hand of man, with the exception of a thumb. The creature walks upon the two middle fingers, while the others dangle behind, and are known as "dew claws." In the deer we get a similar arrangement, but the third and fourth metacarpal bones become united after birth, so that we find these bones in early life with two narrow cavities. The same is true with the ox and sheep, but here the outer fingers do not appear, or have been lost, save a horny relic of the same within the skin. The buffalo occupies an intermediate position in this respect between the ox and the deer; for we find the terminal bones of these last fingers in their appropriate place. But the horse shows even more degradation, and is thus the lowest expression of the pentadactyle or five-fingered hand; for this creature walks upon the middle finger alone. The nail is the hoof; the last phalanx is the coffin-bone, in veterinary anatomy; the next, the lower pastern; and the third is the upper pastern. The metacarpal is called the cannon-bone, and those little bones in the back of the horse's leg, called "splints," are the rudiments of the second and fourth metacarpals, and which bore perfect toes in a fossil representative of the horse, known, from its close resemblance, as the hipparion, and which flourished during the miocene period of geology. This fossil horse walked upon or had at least three toes instead of one; and we occasionally find, as a freak of nature, even in the modern horse, such a monstrosity, where these outer toes make an appearance. This becomes, therefore, an interesting problem for the naturalist to determine if there are not some genetic relations in time between the equine genus and *hipparion*.

Thus the veterinary calling, when scientifically pursued, will open a new avenue, and thereby present many allurements in this country for the practical study of comparative anatomy, which heretofore has been confined to only a few co-laborers in this interesting field of inquiry.

The teeth also present many points of interest to the student of veterinary science, and should be carefully studied in the light of morphological anatomy; for by the dentition we are enabled to tell the age of the horse and of our other domestic animals, more or less accurately, according to the

shape of the crown of the lower incisors, especially in the horse. The relative number of teeth in the lower animals, when compared with man, become an interesting problem for the philosophical anatomist. The hog is the only animal now in existence that has a typical set of mammalian teeth of *forty-four* in number. The horse has but forty that are full grown, but those diminutive ones so frequently met with in the upper jaw in front of the grinders, and which are known among the horsemen as "wolf-teeth," are only the representatives of the first premolars of the typical set. They are of no use, nor have they ever been known to do any harm; and yet farriers, all over the country, are pulling these under the erroneous impression that they are the cause of the periodic opthalmia or even blindness, to which horses are so frequently subject during certain seasons of the year. This practice is not very painful, as there are no nerves in them, and therefore they cannot be the cause of these affections; but it simply illustrates the ignorance and quackery which exists in the majority of veterinary practice throughout the country. This subject, therefore, becomes an important one to the farmer; for there are many tricks and devices resorted to among horse-jockeys to make an old animal appear young again. But I will not longer dwell on this topic, interesting as it is to many of you, for I should occupy too much of your time to do the subject justice on this occasion.

The descriptive anatomy of any of the domestic animals will be taught from the fresh subjects in the dissecting-room, and physiology by the way of experiments to illustrate the vital phenomena and the leading facts of the science. But in the line of comparative pathology we shall make special efforts, and thus endeavor to bring the subject down to the latest advances of the science. This is really one of the most essential branches in veterinary medicine, and should be studied with careful attention on both the living and the dead subject. We shall find it necessary to institute certain experimental inquiries, with a view to determine, if possible, the real nature of the virus in pleuro-pneumonia and other contagious affections. Little is known on this subject at the present hour, and hence any new work in this direction will be welcomed by men of science throughout the world.

The botany of our medicinal plants, and the elements of *materia medica*, will be taught by President Clark. Thus every student will be expected to have a general knowledge of medical botany on leaving the college; and, therefore, fully prepared to enter upon the special study of veterinary medicine, in the post-graduate course. All this training is absolutely necessary to fit the mind of the student for such a calling in after years.

And in chemistry we shall take a similar course. Professor Goessmann will make a specialty of medical chemistry and pharmacy, for the benefit of those who wish to devote themselves to the veterinary profession.

If, now, I have enlisted the sympathies of any of you in behalf of the importance of this subject, permit me to call your attention to the steps which are necessary to establish such a department of instruction in your State Agricultural College at Amherst. The first thing that will be required is a suitable building for a lecture-room, for a museum and for anatomical laboratories. Such a structure should be substantially built, and thus calculated for all time. It should be of ample proportions, in order that we may place on exhibition the natural history collection of the State, and other useful material, as well as my own private cabinet of comparative osteology. All these should be neatly arranged, so as to be attractive to the visitor and an ornament to the institution.

We need the skeletons of the various known breeds of domestic animals, and also a few of the Ward series of the casts of fossils on exhibition in the Museum. The specimens to illustrate pathological anatomy can only be obtained by watching the opportunities which may occur from time to time for collection.

With such an array of material at our command to illustrate the comparative anatomy and physiology of the domestic animals, as well as the real pathology in disease, we shall endeavor, with your hearty coöperation, to make this department an honor to the college and a blessing to the State; and I desire in this public capacity to cordially invite our farmers all over the Commonwealth to send to Amherst any mysterious or interesting cases of disease which may occur among your stock, and we shall be happy to examine the same, and

thus prescribe such remedies as the nature of the malady may require. All this we shall do free of expense, and be proud of the opportunity of thus having such contributions to illustrate before our classes the pathology of the existing diseases in the State.

And that we may henceforth earnestly labor together, and thus advance the system of veterinary education in our community, is the earnest wish of your new-made friend.

At the close of the lecture, NEWTON S. HUBBARD, Esq., of Brimfield, offered the following Resolution:—

Resolved, That the thanks of the Board of Agriculture be tendered to the citizens of Fitchburg for their generosity, cordial reception and hospitality during the session of the Board in this place.

After appropriate remarks by Mr. Hubbard, Colonel Stone and the Secretary, the Resolution was unanimously adopted, when the Board adjourned *sine die*.

CATTLE COMMISSIONERS' REPORT.

To the Honorable Senate and House of Representatives of the Commonwealth of Massachusetts.

In presenting their Annual Report, the Commissioners on Contagious Diseases among Cattle are gratified to be able to say that no case of contagious cattle-disease in this State has come to their knowledge since the report of 1873 was submitted.

Although some of our sister States, particularly New Jersey and Maryland, have been visited with a destructive disease, supposed to be contagious pleuro-pneumonia, our herds have been exempt, and the stock interests of the State have been specially prosperous.

The attention of the Commissioners has not been called to even a supposed case of contagious disease, and the discharge of our duties has made no expense to the Commonwealth.

Respectfully submitted,

LEVI STOCKBRIDGE,
E. F. THAYER,
Commissioners on Contagious Diseases among Cattle.

ANNUAL MEETING OF THE BOARD.

The Board met at the office of the Secretary, in Boston, on Tuesday, February 3, 1874, at 12 o'clock, His Excellency Governor WASHBURN in the chair.

Present: Messrs. Baker, Boise, Chadbourne, Davis, Fay, Graves, Hubbard, Knowlton, Ladd, Leavitt, McElwain, Miles, Moore, Phinney, Sessions, Slade, Stone, Sturtevant, Wakefield, Washburn and Wilder.

Voted, To appoint a committee of three on the order of business. Messrs. Wilder, Davis and Fay.

This committee subsequently reported as follows:—

1. Reports of Delegates.
2. Reports on Subjects assigned for Essays.
3. Report of the Committee on the Agricultural College.
4. Reports of Committees appointed last year.
5. Miscellaneous Business.
6. Appointment of Delegates.

The sessions to commence at 10 o'clock, A. M., each day. The Committee on Selection of Subjects for Essays and on the Annual Country Meeting to be appointed on Wednesday.

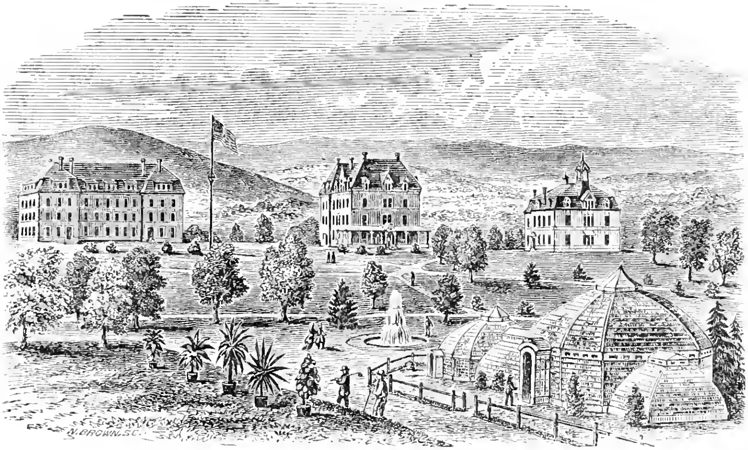
(Signed) MARSHALL P. WILDER.
CHARLES G. DAVIS.
FARWELL F. FAY.

The report was accepted.

Reports of delegates being in order, Dr. Wakefield reported upon the Worcester West; Mr. Kellogg upon the Essex; Mr. Stone upon the Worcester South; Mr. Sessions upon the Worcester South-East and upon the Union; Mr. Phinney upon the Franklin; Mr. Hubbard upon the Deerfield Valley; Mr. Knowlton upon the Hampden East; Mr. Sturtevant upon the Housatonic; Mr. Leavitt upon the Hoosac Valley; Mr. Baker upon the Norfolk; Mr. Fay upon the Bristol Central; Mr. Graves upon the Plymouth; Mr. Leavitt upon the Martha's Vineyard, and Mr. Allis (read by the Secretary) upon the Worcester North.

The committees to whom subjects for essays had been referred not being ready to report, Dr. Wakefield, on behalf of the Examining Committee of the Agricultural College, submitted the following

REPORT:



MASSACHUSETTS AGRICULTURAL COLLEGE.

When I was appointed on this Committee, I was the firm friend of the College. I had been convinced and converted long before. My doubts had all been removed. I believed it was a worthy institution, was already a power, and destined to exert a wider and more benign influence as its facilities increased and its fame was better diffused through the Commonwealth. Thus far I had this advantage over some of my predecessors.

At the close of the winter term, the President notified me, and I appeared, with ears and eyes open, to hear and see what had been done, what was being done, and what was the prospect at this institution. I first directed my attention to the boys, who were already on the ground, ready for business. The freshmen were examined in agriculture by Professor Stockbridge, the sophomores in chemistry by Professor Goessmann, the juniors in botany by the President, and the seniors in English literature by Professor Goodell.

On Monday evening, July 14, prize declamations by the two lower classes, for the gold and silver medals presented

by Isaac D. Farnsworth, took place in the military hall of the college. Four contestants from each class appeared, and were well received by their friends and fellow-students.

On the day preceding commencement, the juniors, sophomores and freshmen were examined in botany, surveying and chemistry by Professors Clark, Peabody and Goessmann, while on commencement day the graduating class was examined in agriculture by Professor Stockbridge, in the military hall, in presence of the trustees of the college, the Board of Agriculture, and a large concourse of their friends and the friends of the college, who had gathered to ascertain what these young men knew about farming.

Among the subjects discussed were the following: Fertilizers, rotation of crops, ploughing-in of crops, plant-growth, construction, composition, how exhausted soils could be restored to fertility, stock-husbandry, the comparative merits of Durhams, Ayrshires, Jerseys, etc. The young men gave evidence that they had studied and mastered the theoretical part of agriculture, and showed that they had views on the subject of stock, and convictions as decided, and could give reasons for their opinions, and were quite as well agreed as the grave and reverend seniors that were present, and became so interested that they could not refrain from enlisting as disputants in the absorbing topic.

The cadets, under the command of Lieutenant Merrill, U. S. A., assembled on the parade-ground, and were reviewed by His Excellency Governor Washburn, and other officials. Their marching, bearing, evolutions and drill were commendable, and showed them soldiers, as well as students.

The degree of Bachelor of Science was conferred by His Excellency on thirteen young gentlemen, with some well-timed paternal advice tending to encourage them to press onward and upward, to battle for the right, and do their duty as men, since the reputation of their *alma mater* was committed to another class to foster and cherish. Four of these appeared on the stage with theses well written, well delivered, full of thought and full of proof that they had something to show for their four years' drill in this institution, yet only in its infancy.

Hon. Justin S. Morrill, United States senator for Vermont,

delivered the address before the Social Union. He chose for his theme, "The Opportunities and Perils that beset Young men in the Pathway of Life." The opportunities that offer to a young man are short, come but once, must be improved at the time when presented, or they are lost forever. The age of the world is propitious. Such improvement, progress, thrift, as everywhere abound, were never enjoyed by young men before. These afford golden opportunities; but they are fraught with peril if neglected and misimproved. Industry is the birthright of the student; but love of ease, the syren-tongued peril ever near, may lure him to barter it for a mess of pottage. It is the key that unlocks his own powers, and opens to the possessor the hidden mysteries and veiled beauties of each department of science and art.

Common-sense, one of the noblest faculties of the mind, is the capital of the scholar. It is a power more widely diffused than genius, and equally worthy of cultivation. It is the distinguishing characteristic of the New Englander; the essential element of his nature; part and parcel of his very being; a kind of trade-mark, that, stamped on the Yankee, makes him what he is, and what nobody else can be.

The senator's remarks throughout were highly practical, tending to stimulate the young man just entering life's pathway to rely on his own powers, and strike out boldly for success, and achieve it, because he is worthy of it.

These young men have great facilities for acquiring a thorough knowledge of all branches of study pursued here, and yet these professors, indefatigable as they are, must have the coöperation of the students, or their efforts are failures. A goose, carried round the world, returns a goose, and a dunce, toted through college on ponies, is no more and no less than that at graduation.

The places and positions of society on the common plane are full, but there is ample room higher up. When the seat of chief justice of the United States court is to be filled, the public mind is sensitive, and demands the highest order of intellect, genius, integrity and virtue, lest the ermine, untarnished by a Marshall and a Chase, might be sullied by an unworthy successor. All cannot fill such positions, but all can aspire to be worthy to be called up higher.

In November, at the close of the term, the freshmen were examined in physiology, the sophomores in agriculture, the juniors in physics, and the seniors in botany. The classes acquitted themselves creditably, and when compared with similar performances a little to the south, forty years ago, they were of a high order. But facilities, advantages and times change, and boys must change with them. Not that every student was a perfect master of the subject he had studied, an adept in science,—the teachers themselves would not claim that,—but these young men were familiar with the principles laid down in text-books and inculcated by their teachers, and showed that they had them fixed in their minds, and could use them in stating a proposition, and defending the same, even when questioned by the professors. Having gathered a few facts, they had made them their own, and had the manliness to stand by their theories and defend their positions. Evidently they had been taught to think, and that is education in its essence.

The dormitories of the college boys, so prone to be anything but patterns of neatness and order, are watched by the eagle eye of the military officer, and under his discipline they are learning lessons which many an older college boy has had to learn some years later from his better half, by "line upon line, precept upon precept, here a little and there a little"; and precious little credit did he get for proficiency in that "woman's school," but oftener the gentle reminder, "'Tis hard to teach old dogs new tricks."

The conservatory is an honor to the institution and to the State. From the laboratory, with its appliances for teaching agricultural chemistry, and its liberal, learned and live professor, so competent to fill such a position anywhere in the world, results may be looked for of the highest order, and expectation without limit must be realized.

The apparatus of the mathematical and philosophical departments, under the direction of competent and zealous instructors, affords the student the best facilities for a full and thorough understanding of the subjects treated.

During the year, portions of the land have been devoted to experiments made by Professors Goessmann and Stockbridge. Professor Goessmann has made some valuable experiments on

beets for the manufacture of sugar, and also proved that the seed can be matured here, while Professor Stockbridge has been making experiments with fertilizers and crops both interesting and instructive, but which have not been sufficiently matured as yet to be given to the public. The care of the garden and the class-work of the student have been intrusted to the charge of Professor Stockbridge, while the management of the farm is committed to John C. Dillon, Esq. Mr. Dillon has the charge of the stock, stock-breeding, dairy, swine, poultry, men, teams, crops, etc., etc., and these in the main are as well cared for and prudently managed as a considerate man ought to expect, when it is taken into consideration that the whole establishment is yet only in its infancy; that many improvements have been planned and but few perfected; that his teams and his men are liable to interruptions from the conservatory, the garden, the vineyard, and calls from all sources in such an extensive establishment, before chaos has been reduced to order.

The farm is not claimed now as a model nor as a money-making concern, but only as in the experimental stage, endeavoring to prove that farming may be made to pay if conducted on scientific principles, and to show the farmers of Massachusetts, if they will avail themselves of the facts here demonstrated and the improvements here proved, how they can turn this information to their own benefit, and out of the teachings and experiments of the college coin money for their own pockets.

During the year, Professor H. J. Clark, the Professor of Veterinary Science, one of the best microscopists of the age, an enthusiast in his department, has gone where the beauties of nature are not seen "through a glass, darkly," while the trustees have been fortunate enough to secure the services of Professor Noah Cressy, who is a live, energetic, practical and practising veterinarian, to fill his vacant chair,—one of the more essential departments of an agricultural college.

Within a short time, by the news of the day, we have learned that the college boating-clubs have removed their headquarters from the waters of the Connecticut to the waters of Saratoga. The bland and enticing invitation of John Morrissey, "Will you walk into my parlor?" etc.,

comes too late to catch the Aggies. The place is too near the setting sun. The apron-strings of alma mater are not long enough or strong enough to hold her darlings from the exhilarating allurements of such a watering-place. The benefits are not to be compared with the dangers. Brain suffers more than muscle gains.

The Agricultural College, with a farm of four hundred acres, which needs all the muscle that can be spared to beautify and adorn its diversified area, need not make a pilgrimage to New York for the sake of performing genuflexions before the golden calf set up upon the plain of Saratoga.

The trustees, the faculty and the students have acted wisely in adhering to their legitimate business, and leaving boating to those who have a larger supply of muscle-force to waste than have the boys of an agricultural college. No doubt prestige was given to the college by its success in the race two years ago; but it was a victory too dearly bought. She has succeeded and she has failed. She may now rest on her laurels. The credit gained by the college among its friends was more than counterbalanced by the discredit it suffered among a class who ought to be its friends,—its warm friends,—but who were made lukewarm or enemies by this engagement in an enterprise which appeared to them improper and unprofitable. It is too expensive a luxury to be indulged in by a young and poor institution, and a too hazardous and exhausting amusement to be tolerated by an agricultural college.

The college affords an opportunity for young men to obtain a good, substantial knowledge of the science of farming, and also a fair knowledge of the practical part thereof, and every farmer's son in the Commonwealth stands a better chance to obtain an education, and prepare himself to meet and grapple successfully with opposing forces, and with honor compete with other young men struggling for honorable distinction in the various pursuits of business, especially every farmer's son who belongs to the poorer class or the class of moderate means, from the fact that this institution has been established. It is a shame that it is not differently fostered and cherished by many of the class whose interest was specially designed to be promoted by its establishment.

Farmers, as a body, have not hitherto, nor do they at the present time, appreciate what has been and is being done for the promotion of information in general, and the diffusion of agricultural knowledge in particular, among the masses of New England farmers. Just mention the subject of the Agricultural College, and, ten to one, you will have to defend it, and even labor to prove that such an institution is in any way promotive of the interests of New England farmers. This is wrong. Instead of its being necessary to argue that such an institution tends to promote the true interests of farming in general, and the poorer and smaller ones in particular, the farmer should be thoroughly rooted and well grounded in this faith, and ready to defend his belief and his institution, for it is emphatically his in inception, development and execution, and his in advantages, benefits and blessings.

It becomes every farmer to consider what has been done for the interests of agriculture. From her public domain the general government has generously donated to every State in the Union, lands, the proceeds of which must be devoted to the advancement of agricultural knowledge. The government of our own beloved Commonwealth early availed itself of this donation and established an Agricultural College. From time to time she has placed her hand in her treasury, drawn liberally and expended generously, till it is already on the high road to success, having graduated three classes, although the college is yet in its infancy and much remains to be done.

Besides attending commencement and the examinations of the classes at the close of each term, I have been at the college every few weeks during the year, and seen the professors and the students in the different exercises, and the farm in its different phases at various times and seasons when no preparation could have been made for special exhibition. I have seen the stock in the barn in midwinter, in spring and in autumn, and at pasture in summer. I have seen the farm in planting, hoeing, haying and harvest time. I have seen the classes in the conservatory, the philosophical and chemical rooms, analyzing flowers and soils. I have found in my visits the boys at the barns with the stock, in the fields at work like farmers' boys, and also on parade like soldiers. I once found

them with Professor Stockbridge cutting and stacking corn. There were boys there that looked as though they might have been trained to the business, while others, more delicate, appeared to be taking their first lesson, looking as if the rows were interminable; but all had to take a hand. I have no doubt these boys will, by this experience and training, be the better fitted to stem the adverse currents which all must encounter in life's struggle, and which will swamp and carry down stream many, unless such training and experience shall have taught them in boyhood to buffet manfully every counter-current they may meet in after-life.

The college has secured the confidence of the general government, the state government, men distinguished in the various departments of science and literature, and scientific agriculturists, while the farmers of moderate means and restricted information, the very men and class for whom the college was especially founded, and who should reap from its organization the largest benefit, hesitate, doubt and hold back. The college needs the confidence of this class, because she needs the boys to educate, but she does not need them half so much as these men and these boys need the knowledge the college can impart, and the learning she can diffuse by educating these young men in the science of agriculture, thereby reciprocally benefiting the individual, the community and the Commonwealth.

If these men could see the students at their work and studies, inspired by the zeal and energy of the professors; if they could know the results flowing from the experiments made by Professors Stockbridge, Goessmann, Cressy and Clark; if they could have heard the compliment paid the college by him who so tenderly loved this institution in common with every other that tends to benefit man, who in his last public effort spoke so exultingly in her praise, and who now sees the wonders of creation eye to eye, and the perfections of the Creator face to face, they would realize what was being done for this class by the college, and cheerfully give it their hearty sympathy and coöperation.

HORACE P. WAKFIELD.

Mr. Slade was appointed Committee on Credentials of New Members.

On motion of Colonel Wilder it was

Voted, To appoint a committee of three to be named by the chair to consider and report what action it is appropriate for the Board to take in regard to the death of Professor Agassiz. Messrs. Wilder, Chadbourne and Knowlton.

The report was accepted. The Board then adjourned.

Second Day.

The Board met at 10 o'clock, A.M., Hon. Marshall P. Wilder in the chair.

Present,—Messrs. Baker, Chadbourne, Clark, Davis, Dwight, Fearing, Goessmann, Graves, Hadwen, Hyde, Kellogg, Knox, Knowlton, Ladd, Leavitt, Loring, McElwain, Moore, Phinney, Root, Sanderson, Sessions, Slade, Stone, Sturtevant, Vincent, Wakefield, L. P. Warner, W. L. Warner and Wilder.

Mr. Slade, from Committee on Credentials, submitted the following

REPORT:

The Committee on Credentials have attended to the duty assigned, and respectfully report the following elections:—

Massachusetts,	Charles S. Sargent.
Middlesex North,	Jonathan Ladd.
Worcester North-West,	Courtlon Sanderson.
Worcester South,	Daniel Dwight.
Hampshire,	Levi P. Warner
Franklin,	Whitney L. Warner.
Union,	Franklin C. Knox.
Norfolk,	Eliphalet Stone.
Barnstable,	S. B. Phinney.
Martha's Vineyard,	Hebron Vincent.

Hon. Marshall P. Wilder appointed by the Executive.

Hon. Paul A. Chadbourne appointed by the Executive for the unexpired term of Professor Agassiz.

(Signed) A. P. Slade,
Committee.

Col. Clark then reported, as delegate, upon the Berkshire Society; Mr. Hadwen, upon the Bristol; Mr. McElwain, upon the Marshfield; Mr. Davis, upon the Hampshire, Franklin and Hampden; Mr. Hawes, (read by the Secretary) upon the

Middlesex South; Mr. Hyde, upon the Hingham; Mr. Ladd, upon the Middlesex North; Dr. Loring, upon the Hampden. The report of Mr. Stockbridge, upon the Highland Society, was also submitted, while permission was given to Col. Wilder, Col. Clark and Major Phinney to prepare and submit reports upon the Worcester, the Middlesex and the Barnstable societies, respectively.

Prof. Goessmann then submitted his first report as State Agricultural Chemist.

REPORT ON COMMERCIAL FERTILIZERS.

In entering upon the duties assigned to the State Inspector of Fertilizers, I found myself, for reasons already pointed out at the late meeting of the State Board of Agriculture, in an unfavorable position for efficient work.

As the main season for an active sale of fertilizers had passed by at the time when the provisions of the new law became binding on the dealers in these articles (from 1st of October, 1873), I decided to confine myself, until farther instructed, to an investigation concerning the present condition of the resources of some of the more prominent substances which serve either directly as special fertilizers or enter into the manufacture of our commercial manures.

A short report of the results of my inquiries I ask leave to present in a few subsequent pages.

After stating in each case the chemical composition of the material under discussion, I propose to mention, not only its late wholesale market price, but to show also by a detailed valuation of its various constituents, the amount which the farmers in our section of the country are usually paying for them in the retail trade. This course I have adopted mainly for the purpose of showing it more conspicuously why the farming community has a good right to ask for the introduction of measures which will protect its interests by establishing the trade in fertilizers on a basis which must ultimately tend to promote a desirable mutual confidence between manufacturers and farmers. The detailed valuation of the principal constituents of the fertilizers is based on figures, which our manufacturers concede to be liberal, namely, 16.25 cts. for each pound of phosphoric acid soluble in water; 13.2 cts. for each pound of

reduced phosphoric acid, *i. e.*, soluble in a solution of citrate of ammonia, of 1.09 specific gravity at from 30° to 40° C. 6.0 cts. for each pound of insoluble phosphoric acid; 30.0 for each pound of nitrogen, without any particular reference to the form in which it is present; 8.0 cts. for each pound of potassium.

I begin with a commercial fertilizer, which is universally considered a standard article, namely,

PERUVIAN GUANO.

To obtain reliable information concerning our annual consumption of Peruvian guano, I addressed a letter during the month of September, 1873, to the agents of the Peruvian government in New York City, Messrs. Hobson, Hurtardo & Co. The prompt answer which I received contained the following passage: "The annual consumption of Peruvian guano in this country ranges between thirty thousand and thirty-five thousand tons, mostly Guanape Island guano, the stock of Chincha Island guano having been lately greatly reduced, and a large number of our customers preferring the former. The prices as fixed by the Peruvian government for three or four years past, have been, and still are, the following:—

"*Chincha Island guano*, per ton of 2,240 pounds, $67.50 gold (= $76.95 currency).*

" Guanape Island guano, per ton of 2,240 pounds, $60 gold (= $68.40 currency).

" These prices rule in all depots, viz.: New York, Baltimore, Charleston, S. C., and Savannah, Ga." An extensive dealer in Peruvian guano, in New York, offered at about the same time 2,240 pounds Guanape guano, in cases of from 10 to 50 tons at $60 gold (= $68.40 currency); retail dealers of the same city asked $60 gold for 2,000 pounds (= $69.50 currency). Farmers in our vicinity paid $80 currency for 2,000 pounds, which is an advance of about $19 to $20 currency per ton on the first price. It has been known for several years past, that the deposits of guano upon the Chincha Islands, after furnishing to the world from twelve to fifteen millions of tons of guano, are almost entirely exhausted. The exportation of guano from the Guanape Islands, Peru, began in 1868. These

* $100 gold = $114 currency at the time.

islands are located about 300 miles north from the Chincha Islands. The amount of guano upon the Guanape Islands and a few localities in their vicinity, is stated to be equal to about five millions of tons, which, at the present annual rate of exportation, would be exhausted within ten years. The manufacture of efficient substitutes for Peruvian guano becomes thus daily more desirable. The following analyses may convey some more definite idea regarding the composition of both the Chincha and the Guanape guano :—

	I. Chincha.*	II. Guanape.
Nitrogen,	13.50	9.70
Phosphoric acid,	14.54	13.10
Sand,	–	14.20

The analysis No. II. refers to a Guanape guano lately sold in our vicinity at $80 per 2,000 pounds. A calculation of this sample, according to prices recognized in our retail trade in artificial fertilizers, shows a value of $92.78 per ton of 2,000 pounds; or, in other words, in case we should buy the same amount of nitrogen and phosphoric acid in a corresponding condition in the shape of most of our ordinary fertilizers, we would have to pay for such an article per 2,000 pounds, $92.78. A good average sample of Guanape guano furnishes us, therefore, nitrogen and phosphoric acid at about $10 to $12 cheaper than most of our home-made fertilizers. However, inferior samples of Peruvian guano are by no means of a very rare occurrence. A very strong illustration in that direction has been furnished of late by an investigation regarding the quality sold in New York City. The examination was made at the request of the New York State Agricultural Society, and the sales carried on by two of its officers. Eleven bags of Peruvian guano were bought of as many dealers, and the samples tested by Mr. Habirshaw, the chemist of the New York Board of Trade. The composition of these samples varied from nitrogen 3.74 per cent. and phosphoric acid 6.04 per cent., to nitrogen

* As genuine Chincha guano is very scarce in the market, this analysis is taken from a former report of Professor S. W. Johnson.

10.97 per cent. and phosphoric acid 15.85 per cent., and they represented thus a value differing from $38.32 to $107.68 per 2,000 pounds. The same price per ton had been paid for each of these samples. In justice to the dealers it must be said, that the guano is sometimes damaged by water during the transportation from the islands or in consequence of having been stored in moist store-rooms.

Fish Scraps and Fish Guano.

The largest amount of fish used for fertilizing purposes is obtained from the fish-rendering establishments along the northern Atlantic coast, from Maine to the mouth of the Hudson River, including Long Island. Forty-two establishments, according to good authority, have been in operation in that locality during the year 1872. Fourteen of these fish factories, producing 8,270 tons of fish scraps and 291,000 gallons of oil, are located along the shores of Long Island; fifteen are situated along the coast of Connecticut; their annual production amounts to 8,240 tons of scraps and 309,900 gallons of oil. The remaining thirteen establishments are north of Cape Cod, along the coast of Maine; they produced 16,000 tons of scraps and a satisfactory quantity of oil. The total yield of scraps as specified thus, amounted, in 1872, to 32,570 tons. The ton of scraps sold at $16, at the works, on board of vessel; the oil sold at 45 cents on the average per gallon. The entire produce of these establishments during the year 1871 had exceeded that of 1872 about 12,000 tons of scraps, on account of a more favorable season during the fall. The price of the scraps in 1871 had been as low as $9 per ton, while in 1872 they brought more, generally from $15 to $16 for the same quantity.

The present prospects of the fish-rendering business are stated to be very satisfactory. The demand for scraps is represented as exceeding three times the present supply. A large porportion of it serves as the nitrogenous constituent in the manufacture of phosphatic commercial fertilizers, particularly for the Southern trade. One of the main difficulties with which our dealers in the fish refuse matter apparently have still to contend, consists in the want of satisfactory drying and grinding apparatus. This fact alone can explain the

inferior mechanical condition of the fish refuse, and the great difference in the percentage of its moisture, which we quite frequently notice in that article when offered for sale. The line of distinction between fish scraps and fish guano is sometimes too loosely drawn to operate satisfactorily in both directions. A few analytical results obtained by testing some of the fish refuse sold within the State, may prove the propriety of the previous reflection.

Fish Guano.

	I.	II.	III.
Moisture lost at 100° C.,	18.34	9.96	8.30
Animal matter,	55.72	66.11	65.03
Ash constituents,	25.94	23.93	26.66
Nitrogen,	6.17	7.31	–
Total phosphoric acid,	7.2	7.1	–

No. II. was sold at $40; the usual retail price of a good fish guano is $50 per ton of 2,000 pounds. In counting the value of the nitrogen and of the phosphoric acid contained in these samples according to the standard price in retail transactions, we find it to be $45.60 in No. I. and $52.40 in No II., a difference of $6.74 per ton. A good, well ground and dried fish guano belongs to the best class of substitutes for Peruvian guano; it acts, however, slower, for obvious reasons.

Fish Scraps.

	I.	II.
Moisture lost at 100° C., }	80.2	36.53
Animal matter, }		45.52
Ash constituents,	18.78	17.95
Total phosphoric acid,	4.68	–
Nitrogen (in animal matter),	5.06	–

These samples consisted of the coarsely broken up, pressed fish; they sold at $20 per ton to farmers. Their nitrogen and phosphoric acid per ton, in case of a finer mechanical condition of the fish refuse, would be sold by the manufacturer

of the fertilizers to the farmer at about $34. For farther illustration, I add here an abstract from a printed communication of a manufacturer and wholesale dealer in fish guano of this State. The following analytical results of fish guano were given:—

	I.	II.	III.	IV.
Water expelled at 100° C., . .	29.06	19.85	22.17	43.03
Organic and volatile matter, . .	26.79	46.39	60.49	41.70
Bone phosphate, ...	29 67	30.31	17.13	9.99
Nitrogen in animal matter, . .	3.63	6.43	8.38	5.72
Phosphoric acid in bone phosphate,	13.67	13.89	7.85	4.58

Below these printed analyses was stated in writing, "I am selling this fish guano now at $15 per ton, cash, by the carload, March, 1873." No distinction was made as to which of the samples was meant, although there was an unusual difference in their commercial value. This will become particularly plain, by calculating each of these samples according to the usual standard price of nitrogen and insoluble phosphoric acid in the retail transactions.

Incorporated into our ordinary commercial fertilizers,—

No. 1 would be valued per ton, ...	$38 00
2 " " "	55 20
3 " " "	59 70
4 " " "	41 08

There is an actual difference of $21.70 per ton, in the value of sample No. 1, as compared with No. 3. A mixture of equal quantities of these four kinds of fish guano would have produced an article, which, according to the adopted scale of valuation, has to be considered worth $48 per ton of 2,000 pounds. As the composition of such an article would entitle its manufacturer to charge that amount, we find that the farmer is expected to pay somewhat over 200 per cent. on the first cost, merely for getting fish scraps retailed in an improved mechanical condition.

Animal Dust.

This fertilizer, which of late has been introduced into our markets, is prepared from the blood, the meat scraps and a part of the bones obtained in some of the large slaughtering-houses in Boston and its vicinity. Most prominent at present is the manufacture of animal dust at the great abattoir of the Butchers' Slaughtering and Melting Association, at Brighton. I visited the establishment during the month of October last, and could but admire its neatness and its superior accommodations for the work designed. The slaughter-houses are represented to be large enough to take care of three hundred head of cattle and two thousand sheep per day. The daily production of the fertilizer will amount when in full force to six tons. Fifty dollars are charged per ton to farmers. After passing the meat scraps and the smaller and softer bones through the rendering process to secure their fat, the refuse matter is mixed with the blood and dried by steam heat in Hogel's drier. The soup from the boiling of meat and bones containing the soluble saline compounds of both, with a comparatively small quantity of organic matter, is discharged, not paying thus for the expenses for further treatment. The dried mass, when ground and finished for sale, forms a reddish gray, coarse powder, of a peculiar, yet not very offensive, odor. I have had occasion to test it repeatedly. The following analytical statement represents my results :—

	I.	II.
Moisture lost at 100° C.,	6.64	16.80
Animal matter,	56.30	62.86
Ash constituents,	37.06	20.34
Nitrogen in animal matter,	6.24	7.14
Phosphoric acid in ash,	12.01	8.76

The rendering of the bones by steam, under considerable pressure, disintegrates them to such an extent that a part of the neutral phosphate of lime is rendered soluble in a concentrated solution of citrate of ammonia, and is thus in a superior degree ready for assimilation, as compared with ordinary

bones. For instance, in No. 2, 2.79 per cent. of the phosphoric acid present are equal in value to the reduced phosphoric acid of our commercial superphosphates.

Sample No. 1 I have not tested in that direction. Allowing for it a similar amount of phosphate, soluble in citrate of ammonia (2.82 per cent.), as in No. 2, we find, although there is a decided difference in the chemical composition of these two samples of "Animal Dust," that they are accidentally of a corresponding commercial value. The larger percentage of phosphoric acid in No. 1 compensates for the smaller percentage of nitrogen it contains, as compared with No. 2 above.

A valuation of the constituents of the "Animal Dust," according to the basis adopted in commercial transactions ($57.35) proves, that the amount of phosphoric acid and of nitrogen which a ton of it contains, costs the farmer from $7 to $8 less than in most artificial fertilizers sold.

The abstraction of fat, and the boiling and drying by steam, leaves bones, meat and blood, if properly ground, in a very favorable state for disintegration. Animal dust, like fish guano, may serve to some extent as a good substitute for Peruvian guano. It must, however, be considered a special fertilizer on account of the entire absence of potassa. This circumstance has been taken into consideration on the part of the managers of the Brighton works.

To meet the requirements of farmers engaged in general mixed farming, a second fertilizer is manufactured at the abattoir, which contains several per cent. of potassa, by mixing the animal dust with potash compounds. This potassa-containing fertilizer is sold as "Standard Animal Fertilizer." An analysis of it gave the following results :—

Moisture lost at 100° C.,	13.70
Volatile and organic matter,	56.00
Ash constituents,	30.30
Nitrogen in animal matter,	5.90
Phosphoric acid (soluble in citrate of ammonia),	4.36
Phosphoric acid (insoluble in " "),	3.43
Potassium oxide,	2.25

The fertilizer is sold to farmers at $50 per ton. A few additional percentages of potassa would be a judicious change. The fertilizer, however, is fully worth the price asked for it in its present condition.

Messrs. C. A. North & Co., of Boston, manufacture a similar animal fertilizer at their hog-slaughtering establishment.

Their mode of operation resembles quite closely that pursued at the Brighton abattoir. The bones, the meat scraps and the blood obtained from one thousand hogs per day can be treated in their apparatus. Their daily produce of fertilizer is stated to be three tons.

Large establishments of a similar character are in construction at New York City and at Jersey City. It is a fact of congratulation to the farming interest of the Atlantic States, that, with the increase of the meat-packing business in their commercial centres, improved modes of converting the animal refuse material obtained, in an economical and rational way into valuable fertilizers, find a rapid introduction.

Meat, blood and bones contain the most essential substances of the food consumed; their influence regarding the reproduction of the staple crops of the country cannot be second to any fertilizer in our market, provided a suitable mechanical condition favors their speedy disintegration. It matters very little which of our domesticated animals furnish the material —cattle, sheep or hogs. The water contained in the meat of these animals varies from 72 to 79.3 per cent.

Fresh meat	from	cattle	contains	3.29	per cent.	of nitrogen.
"	"	sheep	"	3.15	"	"
"	"	hogs	"	3.25	"	"
"	"	calves	"	3.18	"	"
"	"	horses	"	3.48	"	"

which, on an average, amounts to 3.35 per cent.

—*Peterson.*

In dry meat, the nitrogen varies from 14.30 to 15.72 per cent., provided the fat has been abstracted. The blood of these animals amounts to about one-tenth of the weight of the entire body, and is in all of them of a very similar composition. It contains, on an average, 78 parts of water and 22 parts of dry substance.

Fresh blood contains on an average 3.7 per cent of nitrogen, whilst dried blood contains 16.8 per cent. of nitrogen. Bones differ mainly in regard to the relative proportion of cartilage (a nitrogenous substance) and of neutral phosphate of lime. The harder bones are usually collected for the manufacture of buttons and bone-black, and the smaller and softer bones are left for the manufacture of fertilizers. After having passed through a boiling process, they count in the fertilizer merely as the main source of phosphoric acid ; for the nitrogen of the organic portion of the bones is almost entirely lost in the soup.

The main task for all manufacturers of fertilizers from butcher's refuse, as previously described, is the production of a uniform article, as far as its chemical composition is concerned. Meat scraps, blood and bones ought to be mixed within certain definite proportions, and the drying carried out by a moderate heat to a state of moisture, not exceeding ten per cent. The first-named rule secures a uniform agricultural and commercial value, and the latter tends to keep the animal matter in an unimpaired state of composition.

Ground Bones (Bone-meal).

The composition of the raw and dried bones of our markets depends to a greater extent on the part of the animal whence they are taken, than on the kind and the age of the latter. Their main constituents consist : first, of neutral phosphate of lime, commonly called bone phosphate ; secondly, of a nitrogenous substance, which is soluble in boiling-water, and contains about 13 per cent. of nitrogen ; and, thirdly, of the fat. The latter, and the nitrogenous substances, are quite frequently removed before the bones are turned into fertilizers.

A good bone-meal ought to contain still its original amount of organic matter. The composition of fresh-ground bones, containing but from 8 to 10 per cent. of moisture, is known to vary from 22 to 24 per cent. of phosphoric acid, or from 48 to 54 per cent. of bone phosphate, and from 2.5 to 4.5 per cent. of nitrogen. Articles sold by the same name may, for this reason, differ in value from $8 to $10 per ton. Coarsely ground bone-meal has been offered of late at $30 per

ton, a finer grade at $35, and the finest ground variety at $40. Fifty dollars per ton is, in our section of the country, the usual price charged to farmers. The farmer ought to insist upon getting the bones ground as fine as possible. I have tested bone-meal of L. B. Darling, of Pawtucket, R. I., and found it of a good average composition; its mechanical condition might have been better.

A genuine well-ground bone-meal is the safest and most efficient form among the natural phosphates. Prof. Völcker and others prefer it, even in many instances as more reliable, to most of our ordinary commercial superphosphates.

Those who have paid for years a closer attention to the trade in bone-meal, report of adulterations with sand, coal-ash, gypsum, sawdust, marl, etc., in some instances as high as 34 per cent.

Bone-Black Waste.

The refuse bone-black from sugar-houses is sold at Boston at from $20 to $25 per ton to fertilizer manufacturers. It contains from 72 to 75 per cent. of bone phosphate in a very insoluble form, and ought, on that account, not to be recommended for direct application to the soil. It deserves, however, a particular recommendation for the manufacture of superphosphate.

I have tested samples of bone-waste, from Boston and elsewhere, and find them of a fair composition. Allowing 32 per cent. of phosphoric acid as a low percentage, we find its commercial retail value, according to the adopted standard, viz., six cents for each pound of insoluble phosphoric acid, equal to $38.47.

Superphosphates and Ammoniated Superphosphates.

This class of compounds represents by far the largest portion of our home-made commercial fertilizers. The phosphoric acid which they contain is, as a general rule, obtained either from raw and boiled bones, or from the waste of bone-black, or from two or three mineral phosphates.

I am informed, by a good authority, that about four-fifths of the superphosphates at present manufactured within the United States, are produced from the South Carolina and Navassa Island phosphates. They fill our markets, and are appar-

ently adequate to supply our wants for years. South Carolina phosphates may contain from 20 to 60 per cent. of bone phosphate. Samples, containing from 54 to 56 per cent. of bone phosphate, from five to ten per cent. of carbonates of lime, besides several per cent. of oxide of iron and alumina, on an average, have been sold at Charleston at $8.50 for 2,240 pounds.

The same material, not ground, has been offered at New York and Boston at from $11.50 to $12 per ton. The expenses of grinding are stated to be, per ton, from $1.50 to $2. Navassa Island phosphate, which, in regard to its chemical composition resembles somewhat the former, contains from 65 to 70 per cent. of bone phosphate, and has been sold of late at $16 per net ton of 2,000 pounds, after being dried and ground. The manufacturer of superphosphates pays thus about from 2.5 to 3.0 cents per pound for insoluble phosphoric acid obtained from these two mineral phosphates, and asks the farmer to pay for it at the rate of six cents per pound.

Only a few of the mineral phosphates are well qualified for an economical manufacture of a good superphosphate. Those which contain either larger percentages of carbonates of lime and iron, or of hydrates of oxides of iron and alumina, are unfit for that purpose, for they require larger quantities of sulphuric acid to produce the desired effect, and thus necessitate an increase of the manufacturing expenses.

A pure bone phosphate contains, for every 100 pounds of phosphoric acid, about 120 pounds of lime. By adding 220 pounds of bone phosphate, 140 to 145 pounds of concentrated sulphuric acid ($=1.84$ specific gravity), two-thirds of the lime (80 pounds) combine with the latter, forming 196 pounds of (anhydrated) sulphate of lime, and 100 pounds of phosphoric acid still combined with 40 pounds of lime; this latter combination is soluble in water, and known to chemists by the name of monocalcic phosphate. To produce this compound with the least waste of concentrated sulphuric acid, is the object of the superphosphate manufacturer,—a task which requires some familiarity with the chemistry involved,—otherwise every change in the composition of the crude phosphates, etc., turned to account, must result in the production of super-

phosphates of a varying composition and of a different commercial value. Coarsely ground mineral phosphates, in their natural state, are almost worthless in a commercial fertilizer. As undecomposed bones yield in a much larger degree to the dissolving influence of the carbonic acid in the soil, we prefer superphosphates made from bones to those manufactured from mineral phosphates, in case both contain a larger percentage of insoluble phosphoric acid. To charge the same price for the latter, without reference to the first cost of the crude material, may be profitable to some manufacturers, but cannot be considered fair dealing toward the farmer. The best protection in such cases is to refuse buying those superphosphates which contain more than two per cent. of insoluble phosphoric acid.

The so-called ammoniated superphosphates receive only in exceptional cases their nitrogen in the form of ammonia compounds. In the majority of cases the nitrogen is added in the form of some nitrogenous animal matter,—as ground bones, guano, fish pulp, meat scraps, blood, refuse material from glue-factories, hair, horn, ground leather, etc. Also, Chili saltpetre and potash saltpetre, furnish sometimes the nitrogen in commercial manures.

Agricultural chemists distinguish very properly between actual and potential ammonia. The latter refers to the ammonia, which, in the course of time will result from the decomposition of the nitrogen containing organic matter. In some instances this happens very rapidly; in others it requires months and even years to bring out the full amount of nitrogen for action.

Our dealers in fertilizers have not yet been seriously asked to recognize the great difference which exists between the value of nitrogen in the form of ammonia compounds, guano, meat, fish, blood, etc., and in that of hair, horn, woollen refuse, leather scraps, etc., although in the form of the latter, it is scarcely worth one-half the amount of the former.

A few subsequent analytical statements may illustrate in a general way, what kinds of superphosphates and ammoniated superphosphates we are buying, and what they are worth, according to our commercial standard retail price.

SUPERPHOSPHATES *(Imported.)*

	I.	II.
Total phosphoric acid, ...	14.13	11.19
Soluble " "	11.83	9.16
Reduced " "	None.	0.69
Insoluble " "	2.	1.34

No. 1 is manufactured from South Carolina phosphate; is worth $41.80 per ton. (England.)

No. 2 is manufactured from Canadian apatite, and is worth $33.15 per ton; it was offered for sale at $35.38 per ton. (Canada.)

AMMONIATED SUPERPHOSPHATES.

	I.	II.	III.	IV.	V.
Total phosphoric acid, .	10.07	8.34	17.33	13.25	11.19
Soluble " " .	5.40	4.32	8.28	10.68	9.16
Reduced " " .	1.08	1.45	3 77	0.69	0 69
Insoluble " " .	4.59	2.61	5.28	1.78	1.34
Nitrogen, ...	2.50	4 30	2.03	2.10	2.43
Potassium oxide, . .	None.	None.	None.	None.	None.

No. 1 is worth	$40.80	(Bradley's XL.)
2 "	46.60	(Wilson's.)
3 "	55.34	(Russel Coe's.)
4 "	51.24	(G. W. Miles.)
5 "	47.80	(F. Coe's.)

These samples were, with but one exception, in their value, considerably below the price at which they are usually sold to farmers. Most of them show, to say the least, some loose management in regard to their manufacture. The results of Prof. S. W. Johnson, Prof. P. Collier, Dr. Nicholson and others point in the same direction.

VI.

Prof. J. M. F. Wellmich's Chinese Plant-food.

(Price, 50 cents per box of two pounds.)

Total phosphoric acid,	8.12	per cent.
Soluble "	0.48	"
Reduced "	1.72	"
Insoluble "	5.92	"
Nitrogen,	2.68	"
Potassium oxide,	0.49	"
Gypsum,	52.84	"

Allowing $12 per ton for finely ground gypsum, this article is worth per ton of 2,000 pounds, $35.44.

It is sold in paper-boxes containing about two pounds each, at 50 cents per box, making $500 per ton, including the boxes.

Crude Sulphate of Ammonia.

The ammonia contained in this compound, is usually obtained as a by-product in the manufacture of animal charcoal from bones and other animal matter, and in the production of illuminating gas from bituminous coal. The unpleasant odor, which characterizes all the products resulting from these operations, renders the ammonia, even after a careful separation, without entering into unusual expenses for refining, unfit for other applications in the industrial arts. It suffices for agricultural purposes to collect the ammonia in a moderately diluted sulphuric acid; to evaporate to dryness after the acid has been neutralized, and to heat subsequently the residue for the removal of the empyreumatic oils. An inferior color and some odor do not affect its fitness for fertilizing purposes. The ammonia obtained in both operations has been formed during the destructive dry distillation of both the bituminous coal and the animal matter. However, not all the nitrogen contained in either kind of substance, is changed into ammonia. Scarcely one-third of the nitrogen contained in the coal, for instance, is transformed into that compound. The remaining two-thirds combine with carbon and sulphur, forming cyan and sulpho-cyan. The degree of

heat applied affects also the relative proportion of ammonia and cyan-compounds. As the gas-manufactories at present furnish the main portion of the commercial crude sulphate of ammonia for agricultural purposes, it may be of interest to study somewhat closer the industrial importance of the production of ammonia from bituminous coal. I feel obliged to refer to the results obtained in England.

Lancaster coal contains 1.25 per cent. of nitrogen. Newcastle coal contains 1.30 per cent. of nitrogen. Scotch coal contains 1.44 per cent. of nitrogen.

One ton of Newcastle coal contains at the previously stated rate, 26 pounds of nitrogen, which is equal to 30.57 pounds of ammonia, or from 122 to 123 pounds of dry sulphate of ammonia. The actual amount secured, varies however from 16 to 24 pounds per ton. The gas-works of the city of London, which consume annually about one and a half million tons of coal, can produce from 16,000 to 18,000 tons of sulphate of ammonia.

I have tested repeatedly the quality offered in our markets and obtained the following results:—

	I.	II.
Ammonia, ...	24.75	24.90
Equal to nitrogen, ...	20.39	20.57
Sulphuric acid, ...	58.26	58.77
Moisture and insoluble matter, ...	16.99	16.33

Both samples were offered for sale at 7 cents per pound by the cask. One pound of nitrogen costs, therefore, in the retail trade 28.2 cents. Fertilizer dealers are charging 30 cents per pound of nitrogen, without reference to the form in which it is present.

Crude Nitrate of Soda (Chili Saltpetre).

The consumption of this compound has of late greatly increased. Some twenty years ago three vessels were sufficient to carry on its exportation. At present, judging from recent reports, there are now a hundred vessels waiting in the port of Iquique, Peru.

Thirty-one establishments, supplied with excellent machinery, and situated along the railroad, served until recently for the manufacture of soda-nitre. Their manufacturing capacity amounted to 1,250 tons per day. There are now some twenty more factories in course of construction, calculated to raise the daily produce to 19,000 tons, or 5,750,000 tons per year.

The Peruvian government has lately placed on it a tax of 25 cents per one hundred pounds, and also restricted the manufacture to 4,500,000 tons per year. The standard strength of the soda-nitre is set down at 95 per cent.; yet this quality has been of late but rarely noticed, on account of the unsettled condition of the revenue laws in Peru. The article sold in our markets has been more frequently found to contain from 91 to 92 per cent. of soda-nitre. As the bags in which it arrives in our ports are frequently rotten, new bags being supplied, one-eighth of one cent per pound is usually charged for repacking. The price during the month of July last was from $3\frac{1}{4}$ to $3\frac{3}{8}$ cents gold per pound (including new bags) by the ton. The strength of that article was 92 per cent. of nitrate of soda, or 15.15 per cent. of nitrogen. One pound of nitrogen in that quality of soda-saltpetre cost, therefore, 24.5 cents currency.

A large proportion of the crude Chili saltpetre serves at present for the manufacture of nitrate of potassa, commonly called saltpetre, by means of the chloride of potassium of Stassfurt, Germany. Nitrate of soda and chloride of potassium produce, by mutual exchange, chloride of sodium and nitrate of potassa. The introduction of this process explains the present lower price of common saltpetre as compared with former years. Crude nitrate of potassa, containing from five to ten per cent. of moisture and impurities, is offered at Boston at from eight to eight and one-fourth cents per pound by the ton. A sample bought at that price contained 90.80 per cent. of nitrate of potassa (equal to 42.44 per cent. of potassium oxide and 48.36 per cent. of nitric acid, or 12.44 per cent. of nitrogen, representing a value of but $142.60 per ton) according to the standard price previously adopted. Nitrate of potassa proves thus to be a too expensive form of nitrogen and potassium oxide for general fertilizing purposes.

German Potash Salts.

These salts, on trial since 1860 in the agricultural industry of Germany, have acquired from year to year a greater importance throughout Europe. They have of late also found their way into our markets, on account of the daily increasing scarcity of suitable cheap potash compounds for fertilizing purposes. Larger quantities have been used upon our farms during the past year than in the preceding one. The demand for experimental purposes has frequently exceeded the supply, particularly as far as the higher grades of these compounds are concerned. Our prices have been higher as a general rule than a well regulated importation would sustain for any length of time. The most serious feature, however, regarding our past supply, consists in the fact, that inferior qualities of the potash salt have frequently been imported.

A few subsequent analytical statements concerning samples tested by me during the past year may prove the correctness of this assertion.

I.

Crude Stassfurt Potash Salt (uncalcined).

Chloride of potassium (equal to 9.8 per cent. of potassium oxide),	15.50	per cent.
Chloride of sodium,	23.90	"
Chloride of magnesium,	10.39	"
Sulphate of lime,	5.00	"
Sulphate of magnesia,	15.62	"
Sand, etc.,	3.76	"
Water lost at 100° to 120° C.,	25.83	"
	100.00	per cent.

II.

Artificial Kainite, or Crude Calcined Potash Salt.

Sulphate of potassa (equal to 12.93 per cent. of potassium oxide),	23.89	per cent.
Sulphate of lime,	3.45	"
Sulphate of magnesia,	6.75	"

Chloride of sodium,	40.34	per cent.
Chloride of magnesium,	10.44	"
Sand, etc.,	1.56	"
Water lost at a 100° to 120° C.,	13.57	"
	100.00	per cent.

III.

CRUDE CONCENTRATED SULPHATE OF POTASSA (calcined).

Sulphate of potassa (equal to 30.41 per cent. of potassium oxide),	55.50	per cent.
Sulphate of lime,	2.20	"
Sulphate of magnesia,	28.87	"
Chloride of sodium,	3.34	"
Sand, etc.,	1.12	"
Water lost at 100° to 120° C.,	8.97	"
	100.00	per cent.

Sample No. I. was imported in Boston; Nos. II. and III. were secured from an importer in New York. No. III. sold at $3\frac{1}{8}$ cents per pound, by the cask, or 10 cents per pound of potassium oxide. Higher grades were decidedly scarce.

Judging from these analytical results, I do not hesitate to express the belief, that our importers have not yet sufficiently studied the interests of our farmers. Potash salts like Nos. I. and II. above, are for several reasons quite objectionable. They are of an inferior character, on account of the large admixture of chloride of magnesium, a compound which is known to be injurious to many of our farm plants, and they contain also, comparatively speaking, a small quantity of potassium oxide, accompanied by from 87 to 90 per cent. of compounds of but little value, which cause a large expense for freight, and thus an unnecessary increase in the price of the former. The higher grades of the (Stassfurt) German potash salts are for us decidedly preferable.

To give some more definite idea concerning the condition of the potash industry (at Stassfurt) in Germany during the past year, I present subsequently a copy of a price-list of one of the most celebrated German potash salts manufacturers, dated Stassfurt, June, 1873:—

	I.	II. (a)	II. (b.)	III.	IV.	V.	VI.
Chloride of potassium,	–	30.9	43.5	–	–	–	–
Sulphate of potassa, .	19.	11.7	10.	28.5	80.	.3	54.
Chloride of magnesium,	14.2	8.6	6.7	15.6	–	.2	–
Chloride of sodium, .	42.	32.	26.	28.6	–	15.	2.5
Sulphate of lime, . .	–	–	.6	2.9	–	1.1	–
Sulphate of magnesia, .	13.6	8.	7.	17.6	–	.4	37.
Insolubles, . . .	4.8	1.6	1.4	2.	–	.5	3.5
Moisture, . . .	6.4	6.8	4.8	5.	–	–	3.

Price per ton of 2,000 pounds.

No. 1 contains from 9–11 per cent. of potassium oxide, ...	$10 04	gold.
No. 2 (a) contains 25 per cent. of potassium oxide, ...	21 60	"
No. 2 (b) contains 30 per cent. of potassium oxide, ...	31 20	"
No. 3 contains from 15–18 per cent. of potassium oxide, ...	15 12	"
No. 4 contains 43 per cent. of potassium oxide,	65 52	"
No. 5 " 50 " " "	40 32	"
No. 6 " from 28–30 per cent. of potassium oxide, ...	51 82	"

These prices apply to quantities less than five tons; above that amount reductions are considerable. The value of the potash varies per pound, as may be noticed from the previous statement, from 4.5 cents to 7.6 cents. It is more expensive in the form of a sulphate than in that of a chloride. In regard to further details concerning the most approved modes of their application for special purposes, I refer to a previous communication published in the tenth annual report of the trustees of the Massachusetts Agricultural College.

Native Sulphate of Magnesia (Kieserite).

This compound occurs in large quantities in the salt mines at Stassfurt, Germany, either in isolated layers or associated more or less with the various constituents of the previously described "potash salts." There are two forms in which

this mineral usually is offered for agricultural purposes. One consists of the selected pieces of the crude mineral, merely crushed to a coarse powder; it forms, therefore, a more or less wet mass of a bluish gray color. The other is of a yellowish gray color, and consists of the slightly calcined and subsequently coarsely pulverized crude mineral. The following analyses illustrate well their respective composition and value:—

I.

CRUDE KIESERITE.

Sulphate of magnesia,	54.56
Sulphate of lime,	9.23
Chloride of magnesium	2.12
Insoluble matter (sand, etc.),	3.00
Water,	31.09
	100.00

II.

CALCINED NATIVE SULPHATE OF MAGNESIA.

Sulphate of magnesia,	75.94
Sulphate of lime,	2.80
Insoluble matter (sand, etc.),	1.52
Water,	19.74

No. I. has been offered for sale in Baltimore at from $11 to $12 per ton; No. II. is offered at Stassfurt at $10.80 (gold), in cases of less than five tons. The comparative cheapness of this magnesia compound has caused of late careful inquiry on the part of German agricultural chemists regarding its agricultural value. The results obtained leave no doubt about its merits. As sulphuric acid and magnesia are known to be essential for the growth of plants, a (artificial) direct supply to the soil must be considered very judicious, wherever large quantities of both have been removed from the soil by the crops raised upon it.

Sulphate of magnesia aids also in a superior degree in the distribution of the potassa throughout the entire body of the soil, down to the subsoil; it exceeds greatly the gypsum as an absorber of ammonia. To sprinkle daily a few pounds of it over the fresh stable-manure, suffices to secure all the

advantages mentioned, provided the liquid-manure is carefully collected.

An impartial consideration of the preceding statements shows that the present condition of our trade in fertilizers exposes the farmer, in an unusual degree, to serious losses; for the peculiar nature of most of our compound commercial manures renders it impossible for him to recognize by a mere casual examination even their approximate commercial value. Nothing short of a careful investigation regarding their chemical composition and the physical condition of their principal constituents, can secure a correct idea regarding that question. My inquiries, as previously stated, tend to support the impression,—quite generally entertained by all those who have of late taken pains to study the character of many of our fertilizers offered for sale,—namely, that articles of considerable less value than represented by the dealers are by no means of rare occurrence. Samples of the same brand even are noticed to vary at times in value from $10 to $15 per ton. In mentioning these facts here, I do not intend to charge an entire class of business-men with intentional fraudulent practice; nothing, in fact, can be farther from my intention, for I feel quite sure that, in the majority of cases, the main cause of the variations in the value of our fertilizers can be proved to be due to the vague notion on the part of many of our manufacturers of commercial fertilizers regarding the extent of the differences which, at times, do exist in the chemical composition of the various crude materials and refuse-matters used in the preparation of their so-called standard fertilizers.

My previous discussion regarding the composition of guano, fish, meat scraps, bones, mineral substances, etc.,—substances which, in a large degree, serve as crude stock for the manufacture of the main bulk of our ordinary commercial superphosphates, and ammoniated superphosphates in particular,—was partly planned for the purpose of illustrating more directly what I consider one of the most fruitful sources of the differences so frequently noticed in that class of fertilizers, even when coming from the same establishment. The simple recognition of the existence of such circumstances does, however, by no means relieve the manufacturer from the responsibility

to comply with his promise, and furnish an article which is worth in the general market the price charged. In case his present mode of manufacture does not secure a desirable uniform composition of his fertilizer, all he has to do is to apply more rational means to obtain that end.

Some manufacturers of fertilizers have, apparently, thus far, confined themselves too exclusively to the task of teaching the farmers how to use the articles which they chance to prepare for them. It seems not out of place, on the part of the farmer, to return the compliment, by reminding them that their mutual interests will be benefited by the introduction of a better system in their mode of manufacture, and by more intelligent analytical statements concerning the composition of the fertilizer they offer for sale.

CHARLES A. GOESSMANN,
State Inspector of Fertilizers.

AMHERST, MASS., Feb. 2, 1874.

The report was accepted.

Voted, To appoint a committee of three to consider and report a list of subjects for essays, to be assigned to committees for investigation. Messrs. Chadbourne, Clark and Sturtevant.

Voted, To hold the next country meeting at Westfield, Dec. 1st, 2d and 3d.

Voted, To appoint a committee of three to consider and report upon the assignment of delegates. Messrs. Slade, Graves and Leavitt.

Mr. Slade stated that Dr. E. L. Sturtevant, had prepared a paper containing some further information upon the globules in milk, to which he had called the attention of the Board at the public meeting at Fitchburg, as stated on pp. 93 and 95, and asked leave, which was granted, to submit it as follows:—

MILK:

SOME CONSIDERATIONS CONCERNING ITS MORPHOLOGY.

The philosophy of breeding teaches that every observed effect must have been preceded by an adequate cause, and that intelligence and skilled observation may enable our reason to trace out the sequences which connect the one with the other with such exactitude as is permissible to our knowledge.

It also teaches that inheritance is a force as uniform in its action, and as invariable, as is the law of gravity; like gravity, its action is modified and interfered with by opposing forces which disguise oftentimes its phenomena. As gravity acts alike on the feather and the bullet, so does inheritance act alike on all animals. In vitality, we have such a complexity of phenomena that a right interpretation is oftentimes difficult, if not impossible; yet the grand law of inheritance, the propagation of qualities possessed by ancestors, may be disguised in individuals, but cannot be denied to the race.

It is to this universal law of inheritance, as modified by other laws, the resultant of whose forces is the animal form, that we are to seek the explanation of the variations that occur between members of the same species, breeds, families and individuals.

Those features of animal form that are readily cognizable are usually more changed by the breeders' art than other features which are not so readily noted. Consequently, the grazing-breeds have been brought to a greater uniformity and perfection than have the dairy-breeds, as the changes to be desired have been more clearly indicated in the beginning and recognized in the achievement. Changes in the dairy-breeds are to be understandingly brought about by breeders and farmers who have a practical belief in the universality of law—that inheritance of form is not more important in modifying the shape of body, than it is in determining the products from the animal.

Whether a cow's milk is better fitted for the making of butter or cheese, or for any other purpose, is largely determined by inheritance, as is also the amount she will give; the manner in which she will give it; the economy with which she will produce it from her food, and the effect of the production upon the health of the animal.

Milk is the product of the mammary gland, and is a fluid intended for the nourishment of the infant animal. It contains, therefore, all the elements needed for nutrition and growth; chemically, is a perfect food; in practice, will support life from infancy to maturity.

In composition it varies greatly in the amount of its proximate constituents, dependent somewhat on the individual cow,

the time of milking, the food, and undoubtedly the breed, for upon examining the milk of widely different species we find constant differences. These differences are transmitted by inheritance, for we cannot imagine a porpoise producing cow's milk, or a cow yielding milk like that from the porpoise. There is reason, then, in believing that each breed produces a milk which differs in its percentage or other arrangements from the milk of other breeds.

Milk is one of the products of the animal body which possesses a form. It is composed of myriads of minute globules of mixed fats, inclosed each in an enveloping substance, which not only preserves the form, but protects the contents from the act'on of ether. These globules float at will in a colorless fluid composed of sugar of milk, caseine, etc., in solution. These globules, by their structure, give to the combined fluid a physical quality, as distinct from chemical quality.

As these globules possess form, and undoubtedly have at one time been a portion of the animal structure, it would be expected *a priori* that they would differ somewhat in various breeds, or, expressed otherwise, be subject to the observed laws of inheritance. As the shapes of animals have been modified to suit human needs or fancy, through the taking advantage of those laws controlling form, we should likewise expect that these globules, either knowingly or unwittingly, would participate in changes, and would bear a relation to the wants or requirements of the breeder.

It is in fact through the study of inheritance and a fixed belief in its universality as a law, and in a firm belief in the doctrine of causation, that I have been led to the investigation whose results I am about to give. As I felt conscious that no treatment or system of treatment of animals could fail to produce some lasting effects on their structure, and as changes in form are more clearly expressed than other changes more involved, such as character and function, I was led to consider milk in its morphological aspects, and first seeking changed forms, to next attempt the following of such changes to their logical conclusions, being careful to test each step by careful experiment.

My opportunities have been limited to three breeds, the

Ayrshire, the Jersey and the Dutch, those large black-and-white cattle from Holland. Although these discoveries are probably of universal application, yet in this paper the conclusions will be confined to the results of my own examinations, which have been fairly complete with reference to the Ayrshire and Jersey milks, but more limited with the Dutch.

Milk in General.

The globules in milk are of varying sizes, some so small as to appear as granules under a magnifying power of 800 diameters, others very much larger. The small globules,—for an increased power has invariably defined them as such,—I shall for convenience term granules. As $\frac{1}{27000}$ inch is, with my micrometer, a convenient division, I shall speak of all globules less than this figure as granules, and all above as globules. Every sample of milk I have yet examined has shown these granules, yet in some milks much more abundant than in others. In the skim-milk the granule has always been readily found, even when rare in the cream. These globules being composed of various fats surrounded by a pellicle, are intimately mixed with the milk as it comes from the cow, but their position soon becomes changed as they come under the influence of gravity; they rise to the surface of the milk to form cream. As the weight of the covering to the fat globule, which is heavier than water, increases proportionately to the volume of fat as the sphere is diminished in diameter, the various globules show difference in physical action. When the weight of the covering is just or nearly sufficient to balance the low specific gravity of the fats, the globules remain nearly stationary in the fluid; when, however, the globule is large, the specific gravity of the mass is so much less than that of the fluid in which it occurs, that it speedily reaches the surface. It therefore follows that the upper layer of the cream is composed of larger globules than the lower layer, or, giving expression to a general fact, the further you go from the surface of milk which has been at rest the smaller the milk-globule.

Experiment I.

Three drops of milk were taken from a vessel containing milk which had been undisturbed for fourteen hours:—

1st drop.	Top layer cream, average size of globule,	6120″*
2d "	Lower layer cream, average size of globule,	6640″
3d "	Six inches below the surface, average size of globule, ...	8260″

Should the globules which occur at these different depths be churned, it would be found that the different layers would require a greater or less exposure to the churning action to produce butter, and the butter would vary somewhat in quality in each churning. This may be easily verified by skimming a vessel of milk at intervals, and churning the cream of each skimming by itself.

The process of churning consists in breaking the covering of the milk-globule and collecting the fat into lumps. This breakage usually occurs through friction, and the ease with which it occurs is determined in part by the toughness of the investment, and in part by the size of the globule.

In general, the time required for churning milk or cream into butter has a close relation to the size of the globule.

Experiment II.

Three Jersey cows, on similar feed, yielding same amount of milk. The milk of the same milking, set on the same shelf, and the cream churned as nearly as possible at the same time, by stirring in a pitcher with a spoon :—

NAME OF COW.	Average size of Globule.	Time of Churning.
Desdemona, ...	4440″	13 minutes.
Gazelle, ...	5260″	30 "
Beatrice, ...	5520″	34 "

Experiment III.

The milk, except when otherwise stated, was in this experiment fresh from the cow, and cooled to 60° by immersing the Florence flask used as a churn in cold water :—

* The sign ″ signifies 1000ths of an inch. To illustrate: these figures are to be read 1-6120th of an inch, 1-6640th of an inch, etc.

Average Size of Globule.	Time churned.	Butter first showed.
5680″ (cream),	3 minutes,	–
5940″	8 "	5
6768″	25 "	15
8252″ (churned with egg-beater),	50 "	36
8320″	60 "	–

Having established the fact, that the size of the globule determines some of the re-actions in the churn, we will consider the effect of churning milk containing globules of widely different sizes. Whenever such trials have been made and the results carefully noted, I have found that the larger globules become divested of the covering first, and oftentimes, being overchurned, hinder the same process from going on with the same facility for the breaking of the smaller globules. The overchurning of butter destroys the grain, or the natural form in which the butter is contained in its investing coating, and releasing the oleine furnishes to the fluid, in emulsion, this oil, which decreases the friction to which the globules are subjected in order to produce butter. The product is, therefore, theoretically retarded and diminished.

Experiment IV.

Carefully measured 16 fluid ounces of milk fresh from the cow and cooled to 60° by immersing the Florence flask used as a churn in cold water. After twenty minutes churning the butter was collected by straining the fluid through fine linen. The amount, 59 grains, or a proportion of one pound of butter to about sixty quarts of milk. The next day, churned the buttermilk. After an hour and a quarter's agitation 211 grains of butter were collected.

This milk threw up 12 per cent. of cream, and was, therefore, of good average quality, as was also indicated by the butter proportion of one pound of butter to about thirteen quarts of milk.

We must seek the explanation of this experiment in the physical re-action of the globules.

Average of ten measurements of the globules occurring in a line $\frac{1}{100}$ inch in length :—

Top layer of cream,	6345″	Lower layer of cream,	8180″
" "	6300″	" "	6390″
" "	6255″	" "	8505″
" "	6480″	" "	8100″
" "	6010″	" "	7155″

The granules in the lower layer were very numerous, but not considered in forming our averages.

The impression gained on observing this milk microscopically was a great variation in sizes of globules, so much so as to suggest a division in two classes, as if two different globuled milks had been mixed.

If the measurement of 100 globules of the cream may be taken as giving an indication of an average, we had 24 globules larger than 6,750′, and 76 globules of that size and smaller, a proportion of about 1 to 3. The proportion of butter between the results of the two churnings was about one to $3\frac{1}{2}$, a correspondence sufficiently close to be suggestive, and, taken into consideration along with the microscopic investigation of the buttermilk, offers the explanation that the larger globules principally furnished the butter of the first churning, while the smaller globules were the principal factors in producing the butter in the second churning.

This experiment can be verified in a very simple way, by shaking some milk in a clean white glass bottle. After a short time specks of butter will be seen adhering to the glass, the product of the breaking of the largest globules, while it may be a long time before the butter will appear in the ordinary acceptance of practice.

Another consideration in the study of the globule is the effect of the distance of the cow from calving, on the size. As a constant result with me, the further from calving the smaller the globule, and I think the more uniform the sizes.

Experiment V.

The milk of the same cow at various periods from calving :—

Days from calving,	$1\frac{1}{2}$.	Average size of globule,	4400″
" "	$3\frac{1}{2}$.	" "	4666″
" "	33.	" "	6000″

Experiment VI.

Three cows of the same herd, and under the same treatment. The trial was made with milk of the same milking, treated alike :—

	Days from calving.	Average size of globule.
No. 1, ...	15	4440″
2, ...	27	5260″
3, ...	40	5520″

No. 3 had a great uniformity of globule, and very few granules. Except for the granules, No. 1 had been as uniform. That the "feed" did not probably affect the experiment unfavorably in this case, I give below, not only the food, but the proportion of butter to milk.

	Butter to Milk.
No. 1. Pasture and ½ quart oil-meal, about 2 to 3 quarts shorts, .	=1 lb. : 23.23 lbs.
2. Pasture and 3 quarts oil-meal, 3 quarts shorts, 1 quart oats, .	=1 lb. : 23.27 lbs.
3. Pasture and ½ quart oil-meal, about 2 to 3 quarts shorts, .	=1 lb. : 17.77 lbs.

Experiment VII.

Milk of different cows, but the same breed. Measurements taken at different times, and under varying conditions of food, etc. The sequences are not thereupon as regular as in the experiments V. and VI :—

Days from calving,		1½.	Average size of globule,		4935″
"	"	3½.	"	"	4718″
"	"	12.	"	"	5580″
"	"	33.	"	"	6384″
"	"	69.	"	"	5400″
"	"	135.	"	"	6040″
"	"	375.	"	"	6339″

I have also reason to believe that the size of these globules is varied by the feed and condition of the cow, and that

their size has a connection with the grain, etc., of the butter.

That my paper may not be too extended, I will leave these and other questions, and pass immediately to the variations consequent on breed.

Breed Variations.

The milk of the Jersey cow contains a larger globule than does the corresponding milks of the other breeds we are considering. The granules, if present, are but few in number. See Fig. I.

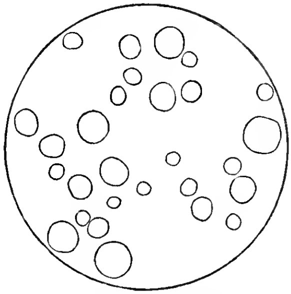


Fig. I.—Globules magnified 813 times.

The milk of the Ayrshire cow furnishes a globule intermediate in size between the Jersey and the Dutch. The prominent feature of this milk is the numerous granules. See Fig. II.

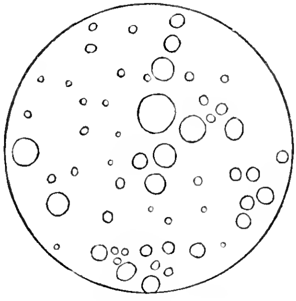


Fig. II.—Globules magnified 813 times.

The Dutch milk showed a globule smaller than in the other breeds. The presence of granules is not a prominent feature,

although there were more present than in the corresponding Jersey milk. See Fig. III.

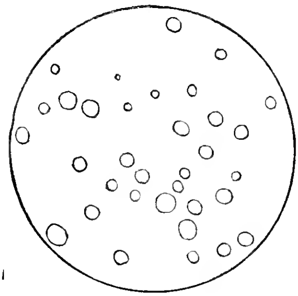


Fig. III.—Globules magnified 813 times.

The properties of the globule also show some breed variations. The envelope to the Jersey globule seems weaker than the corresponding envelope in the other breeds, and more readily broken. This covering in the Jersey milk-globule is also more readily acted upon by the chemical changes induced in the milk by time. When the old cream of these breeds is examined microscopically, it is found that the Jersey globule is more readily broken or distorted by pressure, than the others. Practically, therefore, this milk should be skimmed at an earlier period of the souring change, than should the other milks. I am certain, from impressions gained from my own experiments, that the Jersey milk should be skimmed certainly not later than when the milk commences to thicken or "lobber" at the bottom of the pan, while the Ayrshire milk should pass considerably beyond this point, and develop somewhat more acidity before the cream is removed.

Experiment VIII.

	Average size of Globule.	Cream.	Churning.
Ayrshire, ...	4666″	$3\frac{1}{2}$ days old.	20 minutes.
Jersey, ...	5680″	old.	3 "
Ayershire, ...	6000″	new milk.	25 " *
Jersey, ...	5940″	new milk.	8 " †

* Butter came in 15 minutes. † Butter came in 5 minutes.

Again, if milks be allowed to stand in percentage glasses, it will be seen that not only does each breed have a particular time in which the larger portion of the cream rises, dependent on the size and structure of the globule, but the skim-milk presents differences. The granules in the Ayrshire milk remaining mixed with the fluid give to the skim-milk a white appearance, while the skim-milk of those breeds which do not furnish many granules is blue.

It will be also found that the cream which rises from the milk of these three breeds will not mix again with the milk with the same facility.

Experiment IX.

The milk of the three breeds was placed in a bottle, and the cream allowed to rise, the bottle being corked to prevent evaporation from the surface. By shaking the bottle it was found that the Dutch cream mixed again with the milk with the greatest facility, the Ayrshire cream less readily, and the Jersey cream with difficulty.

It is thus seen, that the form of milk, which undeniably occurs through inheritance,—for otherwise it would not be as constant for breeds,—is important to the uses to which it is applied, and that these considerations have a practical importance.

Let us now proceed from the consideration of breed variations in general to breed variations in detail, and we will therefore consider by itself the milk of each breed, in order that a few of the differences may be more clearly indicated.

Jersey Milk.

The milk of the Jersey cow, from the greater size of the globule and the character of its covering, churns more quickly than does the Ayrshire or Dutch milks. The cream also rises more completely than does the Ayrshire cream, and leaves a bluer skim-milk. The size of the globule affects favorably (apparently) the grain of the butter, and we accordingly find a different texture in the butter, a difference dependent on breed; that is, inherited. This butter is usually, perhaps always, colored by an orange pigment, which seems characteristic. Owing to this orange tinge of the fats, and the

character of the substance investing the globule, the Jersey cream oftentimes appears yellow, especially after standing. This peculiarity of color to the cream is not confined to the Jersey breed, but seems more usually present, or more prominent in this breed, than in the others.

When Jersey butter is shaken in boiling-water, and the nitrogenous matter inclosed washed out and collected, it is found to be much larger in quantity than in Ayrshire butter, and of a somewhat more flocculent character. Hence, theoretically, at least, Jersey butter should not possess "keeping quality" to such an extent as the other butters.

Experiment X.

Some pats of Guernsey, Jersey, Ayrshire and Dutch butter were placed in a warm cupboard, near a steam-heater. The Guernsey butter moulded in spots in about a month; in seven weeks the Jersey butters were all rancid, and one pat had lost its color in spots. The Ayrshire butters were not rancid, but had lost flavor and were poor. (One specimen of Ayrshire butter, in the same cupboard, but on another shelf, retained its butter-flavor and taste for three and a half months, from Oct. 15 to Jan. 30, the date of writing, and although not strictly first-class, yet is fair quality.) The Dutch butter was well preserved, being neither rancid nor flavorless.

Ayrshire Milk.

The milk of the Ayrshire breed indicates a division of the breed into two classes, according as they have been bred for butter or cheese purposes.

The typical butter family of Ayrshires furnishes milk possessing a globule scarcely inferior to the Jersey globule in size; yet the sizes are more varied, and granules present in abundance. The skim-milk is not so blue as Jersey skim-milk, on account of the presence of the granule. The envelope to this globule seems tougher, as the milk takes a somewhat longer time to churn; and the effect of the acids developed in the milk by keeping, appears to affect the churning qualities less. See Experiment VIII.

The butter is of good texture, is yellow, often deep yellow,

but, as far as I have observed, not possessing the peculiar orange tinge of the Jersey.

The typical cheese family of Ayrshires furnishes a milk of much smaller globules, and more numerous granules. The milk throws up a small percentage of cream, and is specially fitted for the manufacture of cheese, as the theoretical essential for the best results in cheese-making is, that the butter should be retained in, and evenly distributed through, the cheese. When cream rises, in the ordinary process of manufacture, it does not again mix with the milk, but passes off in the whey. When, therefore, the milk is rich to analysis,—but the butter globules are so small as to rise very slowly through the fluid,—we have conditions for the most favorable results. I do not question but that, by the means of the microscope, milk could be selected which would endure reasonable skimming, or that amount of skimming which *could* take place in ordinary cheese-making, and yet make a better cheese than another selected milk, which might contain fully as much fat, and be used unskimmed.

As these globules are determined as to size in great part by inheritance, it is thus seen that there is a close connection between the breeder's effort to improve stock and the manufacturers effort to improve the make of his cheese or butter. Minute differences often produce appreciable results, and he who has the knowledge and disposition to select and accumulate these differences in his own favor, is the better farmer and the more prosperous man.

The milk of the Ayrshire cow, which occupies a position between these extremes, is well fitted by its structure for either butter or cheese, without being equal to the typical animal of the typal extremes, for either product alone.

Dutch Milk.

The milk of the Dutch cow seems neither preëminent for butter nor cheese. The globules are quite uniform in size, but small, and therefore require a long agitation in the churn. The absence of granules in an appreciable quantity, as shown by the blue skim-milk, makes it less fitted for cheese than the Ayrshire milk. The property it possesses, of the cream and skim-milk being readily miscible, may offset in

some degree the absence of the granules. The butter made from this milk, so far as determined by a single experiment, was fine in grain, light in color and displayed remarkable keeping qualities. Perhaps the "keeping" power is the direction of the usefulness of this breed. My experiments with the milk of this cow have, however, been too limited to allow me to dwell very particularly on my results.

Milk, as I hope to have shown, is a fluid, not only complex in composition, but in form, and is influenced directly by inheritance. The milk of each breed has, therefore, peculiar properties, dependent on structure. The practical considerations which might be developed from these facts are many and important, but as my paper is already too long, I fear, for the occasion, I will close by giving an experiment which seems to indicate that there is a loss of butter product in mixing the milk of different breeds.

Experiment XI.

Two samples of milk were selected which showed considerable variation in the size of the globule. Twenty fluid ounces of the Jersey milk were divided into two parts, as well as twenty fluid ounces of Ayrshire milk :—

Average size of globules, Jersey milk, . . .	.5252″
" " Ayrshire milk, . . .	.7080″

These milks were then cooled to 60° and churned by shaking in a Florence flask,

Ten ounces Jersey milk. Butter came in five minutes: churned 18 minutes. Product, 136 grains of butter.

Ten ounces Ayrshire milk. Butter came in 20 minutes: churned 30 minutes. Product, 76 grains of butter.

The 20 ounces of milk churned separately produced 212 grains of butter, or a proportion of one pound of butter to 44.75 pounds of milk.

Ten ounces of Jersey milk plus 10 ounces of Ayrshire milk mixed and churned in same manner. Butter came in 13 minutes: churned 20 minutes. Product, 179 grains of butter,* or a proportion of one pound of butter to 48.88 pounds of milk.

* I would note that the buttermilk was churned 10 minutes longer in this experiment, without producing any change in the result.

Difference in gain of churning each milk separately, 33 grains, or 4.13 pounds in the proportion.

This is a result which might have been anticipated from the considerations which have been developed from our previous experiments; for typal relations in milk have reference to a difference in size and structure, and equal forces acting on dissimilar materials could not be expected to produce uniformity in result.

These experiments, it will be understood, are mostly comparative; that is, carried out under similar circumstances, and, however results may be modified by further study, are true *as far as they go*. It will be also borne in mind, that in speaking of breeds reference is had to the type of each breed, and not to the exceptional cow, which may depart in one or more ways from the type of her nearer ancestry.

E. LEWIS STURTEVANT.

WAUSHAKUM FARM, SOUTH FRAMINGHAM, MASS., Jan. 30, 1874.

The paper was read and accepted.

Voted, To refer the times of holding the several county fairs to a special committee of three to consider and report what changes, if any, may be expedient. Messrs. Graves, Stone and Root. The Committee on Printing was constituted by the appointment of Messrs. Hawes, Moore and the Secretary.

Voted, That the Committee on Printing be authorized to condense any matters submitted to the Board, if in their judgment it may be required.

Adjourned.

THIRD DAY.

BOSTON, Feb. 5, 1874.

The Board met at 10 o'clock, A. M., Hon. ALBERT FEARING in the chair.

Present,—Messrs. Baker, Chadbourne, Clark, Davis, Dwight, Fearing, Goessmann, Graves, Hadwen, Hawes,

Hyde, Knowlton, Knox, Ladd, Leavitt, McElwain, Miles, Moore, Phinney, Root, Sessions, Slade, Stone, Sturtevant, Vincent, Wakefield, L. P. and W. L. Warner and Wilder.

Mr. SLADE, from the committee appointed to consider and report upon the assignment of delegates, submitted the following:—To the

Essex,	ROGER H. LEAVITT.
Middlesex,	PAUL A. CHADBOURNE.
Middlesex North,	DANIEL DWIGHT.
Middlesex South,	JONATHAN LADD.
Worcester,	ELIPHALET STONE.
Worcester West,	MARSHALL P. WILDER.
Worcester North,	JONATHAN MCELWAIN.
Worcester North-West,	GEORGE M. BAKER.
Worcester South,	FRANKLIN C. KNOX.
Worcester South-East,	ALBERT FEARING.
Hampshire, Franklin and Hampden,	THOMAS P. ROOT.
Hampshire,	EUGENE T. MILES.
Highland,	CHARLES G. DAVIS
Hampden,	ENSIGN H. KELLOGG.
Hampden East,	HENRY S. GOODALE.
Union,	AVERY P. SLADE.
Franklin,	S. B. PHINNEY.
Deerfield Valley,	HORACE P. WAKEFIELD.
Berkshire,	HORACE M. SESSIONS.
Housatonic,	ELNATHAN GRAVES.
Hoosac Valley,	LEVI P. WARNER.
Norfolk,	JOHN A. HAWES.
Bristol,	GEORGE B. LORING.
Bristol Central,	COURTLON SANDERSON.
Plymouth,	HEBRON VINCENT.
Hingham,	WILLIAM S. CLARK.
Marshfield,	WHITNEY L. WARNER.
Barnstable,	JAMES F. C. HYDE.
Nantucket,	O. B. HADWEN.
Martha's Vineyard,	JOSEPH N. STURTEVANT.

The Report was accepted, and the assignment adopted.

Mr. GOODALE's report, as delegate to the Nantucket Society, was received, read and accepted.

Mr. STURTEVANT submitted a paper containing some suggestions concerning Agricultural Societies:—

SUGGESTIONS RELATING TO AGRICULTURAL SOCIETIES.

The Board of Agriculture may be considered as the guardian of the agricultural interests of the Commonwealth. Its powers, perhaps, are not large, but by virtue of its position and the prestige of eminent persons laborious in its behalf, who have adorned its councils, it has large responsibility. Composed, in great part, of representatives of the chartered agricultural societies of the State, each presiding over its own section of country, and admitted to be the most influential form of associated effort, at present devoted to the improvement of the agriculture of such section,—is it not worthy of the attention of the Board to consider how these local agencies may be made to meet more perfectly the ends for which they exist?

It seems to me the Board can do no greater service to our agriculture than by making itself felt in these societies. In saying this I would not be understood as favoring a policy of control; a deprivation of liberty, in most instances, would be injurious, and I would allow to the societies the same freedom of which they are now possessed, for from it spring originality and strength. Without imposing restrictions, the Board can exercise an influence more far-reaching than comes of such action. It is the individual rather than the society that is to be touched. The latter will not rise above the individual; the quality of a society will be as the quality of a fair average of its working members.

The great need is information and thought. The Board can do something to supply the information, and this is a good seed-bed for thought.

Consider the diverse character of the thirty-one agricultural societies. The highest is below what the lowest should be, and the lowest is below the level where it can render good service. Some of the smaller societies, perhaps, are pursuing practices that others have outgrown. Experiments are on trial that have already been tried and rejected. It is a waste of force to repeat the same in the different societies. There is no such relation of the societies as to prevent this. The best, apart and unbeknown, exerts not its proper corrective or stimulating effect upon others. Should its example be felt, it is

not immediately and completely. Can any one say that the admirable horticultural ideas adopted by the Middlesex Society have gained much currency? Can any one doubt but that the adoption of such ideas has promoted the material prosperity of the market-gardeners of Middlesex?

Again: The New York State Agricultural Society is organized differently, and works in a different manner, from any society we have in New England. Many persons acquainted with it regard it as the model society of the country, being higher-toned and exerting a superior influence to any. But what do we know of this society in Massachusetts? It is true, the Middlesex South Society has recently incorporated in its constitution a valuable feature derived from it. Perhaps some few have benefited by it, but the great body of intelligent farmers are not aware that the New York State Society approaches in excellence several foreign societies,—namely, "The Royal Agricultural Society" of England, and "The Highland and Agricultural Society" of Scotland.

It may happen that some of our societies have a misconception of the object for which they exist. Some may be the exponents of pernicious influences, as when there is brought to a prominence a low class of jockeys, and they in a manner uphold them in their courses. To encourage a taste for the breeding of fine horses is one thing; to encourage an increase in the number of low jockeys, and allow them airs of worthy members of the community, another. Should it occur in any instance that the bounty bestowed by the State is employed to demean her citizens, in place of uplifting her agriculture, there should be some means of putting a check to the evil. This check may be found in publicity and freedom of criticism.

For the attainment of these ends expressed in the phrase, improvement of agricultural societies, it seems to me highly desirable that the Board have a standing committee, whose duty it shall be to become familiar with what pertains to the management of societies and the objects proper to them. Such a committee might be instructed to submit to the Board such critical observations, and such store of information and suggestion having a bearing upon their inquiry, as shall

appear to it to be appropriate and useful. Each annual report of the Board should spread abroad some thought and materials for thought that, germinating in the minds of our citizens of the farm, are calculated to elevate the standard of, and infuse vigor into, the numerous local societies.

Proposed National Academies.

Our numerous agricultural societies in general are to be regarded as important agencies in maintaining and advancing the agricultural prosperity of the State. Their influence is felt by the individual, and is incorporated in his practices; but there is no means of estimating, by referring to any standard, the measure of their usefulness.

They undoubtedly promote and keep alive activity of thought. To get people to thinking is half way to getting them to think aright. Then they occasion improvement in domestic animals, new tools, varieties of fruits and vegetables, etc., to become known to all very rapidly upon their becoming known to any. With these agencies, neighboring communities are not likely to possess themselves of, and derive advantage from, such improvements in advance of ourselves. A want of intercourse among persons having like interests must occasion an inequality that is needless in their circumstances.

The mission of our societies appears to be mainly to disseminate a knowledge of what one man has to many, that they may wish to have the same, so that what is very excellent may become commonplace and freely enjoyed. And it would seem that to carry on experiments in agriculture, to advance agricultural knowledge, in a sense different from that of diffusing what we have, among men, are works of too great difficulty, and are not compatible with the loose and feeble organization and popular character of these societies.

But yet not to have the varied aims, to confine themselves to a distribution of information, as at the annual fair, is only to do a part of what the modern world demands. It calls for invention, new ideas, new explanations; in a word, calls for high intellectual efforts. Having thirty-one agricultural societies, occupying but one-half the field, and as, from their

nature, they can occupy only this, what remains to be done that the whole of agriculture may have some representation in organizations among us?

In these societies, and outside of them, in the State, I believe there exists the material that may be brought together in an association that shall form a nucleus for one coëxtensive with the country, having in it the best intellects the country affords, and willing to engage them with agriculture; the society, to concern itself exclusively with classifying and augmenting agricultural knowledge. This will not be a society in which large numbers will take a personal interest; it will not have popular features; but it may do some good work, nevertheless, that every farmer shall share the benefit of.

Every comprehensive branch of human inquiry, at the period of progression from a low to a higher position, the measure of our knowledge being the measure of position, has been in need of, and has generally received, the stimulus that inheres in associated effort.

We must regard agriculture as being a very old pursuit, and a very new study. Agriculture is likely soon to be regarded as worthy, and claiming the recognition, of minds of elevated tendencies, schooled in the methods of exact thinkers. Such are even now directing their attention to this field of research. The institution of national colleges devoted to agriculture, is an expression of the realized fact,—namely, the dependence of great agricultural results upon intellectual processes, as also the recognition of agriculture as a fit study for the most educated minds. It has hitherto been left largely in the care of so-called self-educated and practical men.

The importance of connecting the several centres of agricultural intellectual inquiry, and bringing into relation individuals engaged in researches directed to one general object, will appear, if we suppose that, at the twenty or thirty agricultural colleges, some light is thrown upon abstruse problems in agriculture, and then consider by what means the world is to be informed of the results of isolated investigators. If in natural history studies one observes something new, there is opportunity at hand of record and preservation of the same in transactions of some society that has currency

among all naturalists. An agricultural observation of value, under existing circumstances, may be embalmed in some publication having but local circulation, and it is late in securing the recognition which is both the stimulus and reward of intellectual labor.

The chief objection that may be brought to the suggestion of a society of the character indicated, and widely different from any existing in this country, I conceive to spring from the variety of topics included under the term agriculture, and the supposed impracticability of chemists, entomologists, botanists, veterinarians, and so forth, finding sufficient support and sympathy to render a society, that should include so much, interesting at all. This objection will, however, seem the less formidable if we consider the composition of several associations existing under the term of natural history societies, or science associations. These are concerned with as great variety of problems,—as many specialties, so called, requiring specialized talent,—as would be likely to combine in an agricultural society of the large scope herein indicated.

It should be remembered, also, that progress of agriculture largely depends upon the concentration of the mind upon the study of specialties, that grouped, constitute the sum of agricultural knowledge.

If, by the permission of the Board, any idea can be sent out from among us that shall occasion any person to set about the difficult task of realizing this object, should he succeed in his efforts, it seems to me the varied talent of Massachusetts, with its distributing societies, its newspapers, its agricultural college and other agencies, may then be said to be perfectly organized in aid of her agriculture.

Respectfully submitted,

JOSEPH N. STURTEVANT.

The paper was read and laid over, under the rule.

The Committee of Arrangements for the country meeting was constituted by the appointment of Messrs. Knox, Sessions, Wakefield and the Secretary.

Voted, That a committee of seven be appointed, with full power to appear before the legislature, to secure suitable modifications to the Act concerning commercial fertilizers. Messrs. Chadbourne, Wilder, Graves, Stone, Fearing, Slade and Sessions.

The reports of delegates were then taken up for a second reading, read by their titles and accepted.

Voted, That, hereafter, the Secretary be instructed to withhold his approval of the payment of any state bounty to any society which shall exhibit grade or native bulls at their annual exhibitions.

The Examining Committee of the Massachusetts Agricultural College was constituted by the appointment of Messrs. Chadbourne, Sturtevant and Root.

Mr. Chadbourne, from the committee appointed to suggest a list of subjects for essays, submitted the following report :—

1. Methods of Improving Fruits. Messrs. Wilder, Sargent, Sessions.
2. Cheap Transportation and Marketing of Farm Products. Messrs. Kellogg, Sanderson, Leavitt.
3. Saving and Preparation of Manures on the Farm. Messrs. Wakefield, Cole, Ladd.
4. Structure and Position of Farm Buildings. Messrs. Stone, McElwain, Root.
5. On the Size and Conduct of Farms in Massachusetts. Messrs. L. P. Warner, Baker, Hawes.
6. Tree Planting and Culture. Messrs. Hadwen, Sargent, Myrick.
7. Mental Faculties of Domestic Animals. Messrs. Chadbourne, Vincent, Wakefield.
8. The Best Mode of Subduing and Utilizing for Tillage the Salt Marshes in this State after they are drained. Messrs. Goessmann, Loring and Phinney.
9. Field and Garden Seeds. Messrs. Moore, W. L. Warner and Slade.
10. Agricultural Improvements — From what source do they come? Messrs. Goodale, Miles, Knowlton.

11. Methods of Improving Farm-stock. Messrs. Sturtevant, Dwight, Hawes.

12. The Claims of Ornamental Gardening upon Farmers. Messrs. Hyde, Fearing, Graves.

13. Buds. Messrs. Clark, Chadbourne, Wilder.

14. Experiments in Potato Culture Messrs. Goodale, Knox, Sessions.

15. Hygiene, and Diseases of Domestic Animals. Messrs. Root, Sturtevant, Hadwen.

Subjects not reported on, may be deferred till another year.

The report was accepted, and the assignment made accordingly.

On motion of Major LADD, it was—

Resolved, That it is the opinion of this Board that the legislature should not incorporate any new societies which shall impair the usefulness of existing societies.

Mr. STURTEVANT, from the committee to which the subject was assigned, submitted the following essay on the

ESSENTIALS OF AGRICULTURAL INQUIRY.

In preparing young men to become efficient farmers, the state college at Amherst is laying foundations that require to be laid before we can expect to have a large and efficient corps of investigators of agricultural problems. It is too much to ask that all the graduates, or a greater part of them, shall be of this class; but we have a right to require that each assist to promote a public sentiment that shall not only allow men of small means to devote themselves to original research, but encourage them in it by substantial assistance. May we not hope that before long some generous friend of the college will endow a chair devoted to original research and instruction in the models of scientific inquiry? For we should recognize the fact that the economizing of both time and talents seems to require that investigation of phenomena proceed after a manner capable, in most instances in its larger outlines, of being laid down in advance. There is order and system around us, and there is always a path that leads

directly to the fact we seek. To put ourselves at once upon the path is difficult, but it becomes less difficult in the measure of the comprehensiveness of our familiarity with the subject as at present known, and our acquaintance with the methods taken to reach truth approved and supported by the foremost discoverers. There need be no apprehension that agricultural investigation demands methods so dissimilar to such as find favor in other lines of inquiry, as to make acquaintance with them foreign to our interests. Rather would it seem to be of the first importance that we approach agriculture with such modes of study and instrumentalities, as in various parts of physical inquiry, have opened wide the doors to knowledge.

Experiments have been said to be "the investigator's language addressed to nature, to which she sends intelligible replies." They are tests of knowledge, and measure with exactness its limits. The experiment is but a *nicer observation*, and the investigation of some men tells them only what others had found out by a kind of instinct. Double the mind's grasp of phenomena, and many of the doubts that fret us are at once removed. It is to double, treble, quadruple our grasp if we can so far clear up our thoughts upon a subject as to analyze it, and set apart those aspects that are analogous from such as are dissimilar, and reduce our doubt to cover a single point, so that our interrogation of nature may be explicit, and have relation to a single phenomenon. With proper framing of the question, the task is half accomplished. What are the contrivances the experimenter invents, but to bring phenomena more clearly before the senses? What are the scales, measures, the thermometer, the sun-dial, the microscope, but attempts to perfect the senses? The good an experiment does for our reasoning, is what the microscope does for our eyes; the latter amplifies our vision; it brings to a severer test what we think we know, and in showing us our errors, discovers new truths. The experiment does much for our reasoning by leading us to facts that other men will accept as facts; for they are obtained by a process, where the experiment is appropriate to the nature of its subject, not to be called in question.

It is common for us to *think* we have facts, that are the outgrowth of our fancy only, and have no support in nature.

All physical truths require this support, and all our investigations are attempts to bring our thoughts, and the data of our thoughts, to a correspondence with the nature of things as they really are. But inventions and contrivances made use of by the individual experimenter do more good than simply to lift him to a higher capacity of observation; they do something more than enable him to see what he could not see without them. They enable him the better to direct his thoughts and concentrate them in a narrow channel; but they also enable others to follow in his path and review his work, because the implements—as scales, measures, etc.—give an exactness to the results, and a precision in the expression of them, as to make the work of several investigators in the same line comparable.

Experiments are of two kinds; the most primitive, interrogate nature, without a guess as to what the answer shall be. Of such were those of Goodyear, who gave us solidified India-rubber. He spent twenty years with trial of substances, mixed with the sap of the rubber-tree, before he effected his object. He worked without data of fact or analogy to guide him, and it was by the merest accident that he discovered sulphur to be the thing he was all along seeking.

At present, in most lines of inquiry,—in nearly all lines of agricultural inquiry,—there is information enough to give a clue to the direction our efforts should take. Our experiment is generally undertaken to "test or establish some truth perceived more or less in advance, or bring to light some truth closely allied."

Plato has said, "Whosoever asketh knows that for which he seeketh in a general notion, or else how shall he know when he hath found it?" When the general notion is wanting, there is likely to be little directness to our inquiry; when it is present, it is for us to reduce it to particularity as far as possible. Allured onward, and in a manner directed in our operations by anticipatory thoughts,—the guess yet wanting confirmation,—the task is to discover how the justness of these is to be brought to a test. Not uncommonly a chance suggestion leads to a train of thought that appears to explain phenomena; but the proof lags behind, and it is difficult to keep it abreast with our reasoning. We look to experiment

for this proof, and the truly scientific investigator is ill-content with theorizing not so supported. When the experiment has this object, it will not be satisfied unless every step in the reasoning is so supported. Reasoning upon premises afforded by analogy is much open to error, and is a slovenly course, when facts in the line of inquiry are to be had. For instance, suppose one asserts that in-breeding in the horse is desirable, is it any denial to show that in-breeding of swine is bad? Certainly not, unless it is first shown that the two classes of animals are so related, that what affects one for good or evil will affect the other in like manner. Experiments should follow a line of inquiry closely and evenly, and not be put off the track by analogous reasoning, without the fullest research to discover whether similarity holds in the comparison,—if likeness exist only seemingly, and not in reality. Analogy, so readily taken hold of by the imagination, leads astray. Experiments, to be convincing, require that they be subject to well-defined, clearly perceived conditions. When experiments cannot be repeated with like results, it shows that like conditions were not present, or that we are not knowing and regardful of conditions that vary the results of repeated trials. It is well worth the care of any one who should wish to be sure, as every one should, of conferring a benefit upon his fellows, rather than risk doing them an injury, to delay the expression of results of experiments until the correctness of their results are tested by repeated trials. We venture the remark that the Massachusetts Board should not give currency to experimental efforts not fortified in this manner.

Escape inferences when possible. The investigator asks; nature responds. If he would know something more, let him ask again; but do not think to support your reasoning, *here* with an experiment, *there* with an opinion. To allow a free rein to fancy in parts of an experiment, though good reasoning prevail in other parts, will vitiate the result. It is not demanded that the investigator shall suppress his imagination; this would be at the risk of valuable suggestions; but it is required of him that he have it under control, so that his efforts of reasoning may not become confused and valueless by the irruption of a lively fancy. It is the weakest links that determine the strength of a chain.

It is only when the processes of an experiment are in a certain sequence—when there are several processes involved, and the whole is represented in a formula, precise and correct, that the experiment of one person is adapted for comparison with that of another. This is so fully recognized by men of good scientific culture, that they rarely express the result of an experiment, without detailing the manner in which it has been reached. In experiments that are any way involved, and are not of the simplest kind, there is demanded an accuracy and definiteness of treatment that is raised vastly above the commonplace. An untiring patience with details, a rejection of all compromise with error to save trouble, is indispensable. How often has some condition essential to success been overlooked, so that our efforts are wasted!

In comparative feeding experiments, the curing of the hay, or kind of grasses that compose it, not to speak of analyses, escape attention; or the animals are not weighed; or, if cattle, conditions are dissimilar, in some of the animals being in a different state of forwardness with calf; or the breeds differ; or a single animal is put against twenty; or there is regularity of treatment opposed to irregularity, and a hundred chances that some particular has escaped us.

A general recognition of the importance of possessing a body of facts in agriculture supported by investigation, led to the assembling, at Chicago, in 1871, of a convention where nineteen agricultural colleges were represented. The object, as stated in the call, was "for the purpose of organizing, consulting and coöperating in the great work of advancing the cause of agricultural knowledge and education, especially by experimentation, under similar conditions, at all the agricultural colleges." There was weakness in the scheme, and all that need be said of the report of the meeting is, that it may hereafter be regarded as an interesting memorial of the scientific conceptions of these infant institutions at date.

Successful investigation depends upon the blending of qualities in the investigator, directed by scientific culture, that may be expected to concur in the few, rather than in the many. *Crowds* may be in the pursuit of a truth, but the *individual* will at last find it; as among a military people

there will be found one man of such large distinctive habit as to give him command over all. Let us cultivate the one man, put trust in him, give him all advantage, where there is a matter of nicety to be inquired into, and be assured that men are not as plenty as states, who can do *that* work as well. There is something so individual in all men as to make one more knowing than all. To him some truth is revealed; to others other truths; and no laying down of rules can reduce or raise men to an equality. For this reason, it will not answer to be too fine. In putting forth the essentials of an agricultural inquiry, the larger outlines may remain, while the nice details will be variable in every mind. To attempt to confine anything so original as the human mind within the precincts of another's devising, would be to restrict and endanger that freedom and courage which is one of the essentials of discovery.

It may be worth while to call to mind a sample of some efforts at experimenting that are upon record. The latest that has fallen under our notice is an experiment intended to show the "Effect of Different Fertilizers on the Cultivation of Lane's Imperial Sugar-Beet." * "The plat was laid out in rows, two and one-half feet apart, and one hundred and nine in length, each row containing about one square rod. The fertilizer was sown in the line of the rows, and well raked in. The ground was then marked in lines drawn at right angles with the rows, and the seeds were sown at the point of intersection, and covered with the hand." The land "was a clay loam, and had been fairly and evenly manured from the stable." There were twenty-five rows; five received no application of the fertilizer; others from $1\frac{1}{4}$ to $2\frac{1}{2}$ pounds of special fertilizer to the row. The result is shown in weight of beets, in pounds, per row.

To inform us of the effect of any fertilizer upon the crop, we must know that without the fertilizer all the rows would have produced the same weight of crop. The experiment assumes that the various parts of the field are of a uniform quality, and that any difference in the harvest is due wholly to the fertilizer employed. Unfortunately for this assumption, the rows which received nothing betrayed the unfitness of the

* See Ann. Rep. of Maine State College of Agriculture and Mechanic Arts for 1872.

land for the experiment, in that the difference of yield of these rows was as great as with the rows that had received the fertilizer. The experiment then does not show what it claims to, namely, the effect of employing different fertilizers. The plan of the experiment was wholly unscientific. Had the land been divided off into squares, each square planted at the same time and in the same manner with beets, and had the land shown a uniform quality, by producing on each square a similar weight of crop, it would have been in a condition the following year for testing the merits of particular fertilizers on that particular field.

Some experiments conducted at the Michigan Agricultural College, designed to test whether the soil of a field was of a uniform quality,—by dividing the field into squares, planting and harvesting the squares separately, but all in the same manner and without any application of manure,—were very successful in showing that various parts of a field, though the soil appeared of the same quality, have an unequal crop-producing capacity. In other instances where fertilized squares alternated with the squares without manure, the latter produced the heavier crop.

The best example of scientific inquiry with which we are acquainted, is contained in Wells' essay on "Dew." Sir J. F. W. Herschel pronounces the theory of dew, as developed by Wells, one of the most beautiful specimens we can call to mind of inductive experimental inquiry lying within a moderate compass. He "earnestly recommends his work, a short and very entertaining one, for perusal to the student of natural philosophy, as a model with which he will do well to become familiar." Prof. Tyndall says: "A series of experiments conceived and executed with admirable clearness and skill, enabled Dr. Wells to propound a theory of dew, which has stood the test of all subsequent criticism, and is now universally adopted." The experiments were performed with the aid of a few, and these the simplest instruments. Thermometers to record the temperature of the air, little bundles of wool to collect the dew, and scales to weigh the amount deposited upon them, a piece of pasteboard bent like the roof of a house, were the principal contrivances employed, but

they opened the way to a closer and more exact observation than could have been had in their absence.

An admirable model of experimental inquiry may be found in Prof. Ville's "Six Lectures on Agriculture." The subject is the "Nutrition of Plants." We know from accurate experiment, that plants require for their growth a supply of certain substances or elements, which chemistry informs us of, that stand to them in the relation of food. Now, the two great questions which concern agriculture are :—1st. What are the food elements agricultural plants require? 2d. How can these be applied to the nutrition of plants? To answer these questions, Prof. Ville instituted a series of experiments, so simple in character, and yet so conclusive, as to command our admiration. He says, "The soil could not be known with accuracy, for chemical analysis had completely failed in ascertaining its composition. I resolved to substitute for it, an artificial mixture, all the elements of which were clearly defined. In this way, I arrived at producing vegetation, in pots of china-biscuit, with calcined sand, and perfectly pure chemical products."

The weight the plants attained, in soils of known composition, differed much, clearly showing that one mixture was more conducive to plant-growth, than a soil differently furnished. Prof. Ville was not satisfied with a few experiments, but made many, all with the idea of excluding from the plant all those elements of nutrition that were not designedly furnished. The conclusion to which the experiment pointed was verified afterwards on a larger scale, in actual field-culture. In this system of Prof. Ville, the plant analyzed the soil,—its own appetite guiding its choice of food. The professor had only to stand by, and observe what food the plant preferred. By observation of the behavior of the plant in the presence or absence of definite chemical agents, we are led to the true principles of fertilization.

In an inquiry directed to discover the influence of in-breeding of plants, and of cross-breeding, as affecting their vigor of growth, Darwin designed a series of experiments, which, to quote his own words, "if they continue to give the same results as hitherto, will forever settle the question of the good effects of crossing two distinct plants of the same variety, and of the

evil effects of self-fertilization." The plan of the experiments seems so simple and obvious, as to have been thought of by any one. Herein we perceive the beauty of it, for it is the art of experimenting, to bring to our operations simplicity, and make the reason for our course plain. The plan followed by Darwin, was to plant on opposite sides of small pots, in pairs, crossed and self-fertilized seed, to exclude insects from them, and to subject them to the same conditions. He had but to await upon nature daily, and observe the vigor of the several plants, each struggling for itself, and calling on the other to answer the question he had set before himself to solve.

Now, such efficient and convincing experiments as those here referred to, require of us not more time than is often consumed on such as are not satisfying. They are of a kind, too, that bring their own compensation, since we have the satisfaction of reflecting, that our work will not have to be reviewed by another, with the likelihood that it will be thrown aside, as so much waste material. Let us, in our agricultural inquiries, adopt the presumption that the premises for many current statements need to be experimentally inquired into, with all the clear-headedness to devise the proper method of procedure, united to the persevering steadfastness, that we honor in those, who, with their telescopes, follow the course of the planets, or in the smaller field of the microscope, inform us of the measure and motion of the minutest form of animal organism. Would it not be a worthy thing to do, for persons who see nothing commonplace in agriculture, when actually taken into the possession of a mind willing to give its best services, to associate themselves with the avowed object of introducing the methods of science into agricultural inquiries?

Joseph N. Sturtevant,
For the Committee.

The Report was accepted.

Mr. Graves, from the committee appointed to consider and report upon any changes that may be required in the times of holding exhibitions, reported that the Barnstable shall hereafter begin its exhibition on the third Tuesday of

September, the Union on the third Wednesday of September, the Hampshire, Franklin and Hampden on the first Wednesday of October, the Worcester South-East on the last Wednesday of September, and the Hingham on the last Wednesday but one in September.

The report was adopted.

Voted, That all unfinished business be referred to the committee on printing, with full power.

Col. WILDER, from the committee appointed to consider and report what action the Board should take with regard to the decease of Prof. Agassiz, submitted the following preamble and resolutions :—

Whereas, Prof. LOUIS AGASSIZ has been removed by death since our last meeting; and, whereas, his connection with this Board has for many years been a great source of enjoyment to all its members, and profit to the people of the State; therefore,

Resolved, That in the death of Prof. Agassiz, the members of this Board recognize the loss of one of the great masters of science, whose membership was an honor to this Board, whose marvellous learning was freely used to foster and dignify the science of agriculture, and whose eloquence and enthusiasm gave a charm to all his instructions.

Resolved, That we recognize with grateful remembrance all he has done for the honor of our Commonwealth, our common country, and for the cause of science in the world, by his own investigations, and the instruction of those who remain to carry on the work begun by him.

Resolved, That a copy of these resolutions be entered upon the records, and be forwarded to his family.

Eloquent remarks were made by Col. Wilder, President Chadbourne, Dr. Loring and Maj. Phinney, when the Resolutions were unanimously adopted by a rising vote.

The Board then adjourned.

The completeness and the high scientific and practical character of the foregoing papers leave little to be said to extend the limits or to add to the value of this Report.

The members of the State Board, in common with the whole scientific world, have been called upon to mourn the loss of one of their associates whom all loved and delighted to honor. His genial and sunny face, so truthfully reproduced in the frontispiece by the newly invented heliotype process, will serve to remind us all of the influence he exerted and the enthusiasm for scientific research and accurate observation which his presence infused into the practical thought of our people. The grandeur of his character, his unselfish and self-sacrificing devotion to the cause of science and the advancement of human knowledge, the exactness of his methods of investigation and the power and magnetism with which he imparted instruction through the lecture or the more informal discussion or debate, have left their lasting impression on the minds of those with whom he came in contact.

The lesson of such a life as that of Agassiz will not be lost. It has lifted our practical community to a higher level of thought, to loftier aims and to nobler purposes. It has, to some extent at least, shown us the possibilities of human culture and the direction which that culture should take. It has given us the model of a popular teacher, who could inspire in others something of his own love for nature and a desire to unfold her charming secrets, and it has set an example of the power and effectiveness of concentrated and persistent labor to attain success.

The Farm for Boys.

It has often occurred to me to say a word for the encouragement of farmers' boys. They sometimes get impatient of the work, the confinement and the restraints of home on the farm. In some cases there is, perhaps, too much reason for it; and in others, and probably the majority of cases, it arises from an idea, by no means well founded, that boys differently situated, in the village or the city, hold a far more desirable position, and have the advantage of them. In point of fact they have no occasion to envy the lot of their city cousins. A long experience and observation, with rare opportunities of comparison, have

satisfied me that the practical labors of the farm which boys are called upon and expected to perform, even the humble chores, with their ceaseless and often monotonous round, constitute the very best and most valuable part of the practical education of life. They do more to lay the foundation of health and strength, of physical and mental vigor, than all the artificial aids of the gymnasium, and all the contrivances for physical culture in the city school,—vastly more.

The advantage which the boy of the city has is only apparent. He is brought up like a hot-house plant, and lacks the strength and vigor of mind which a slower mental development and the health-giving and invigorating air and out-of-door exercise of the country give. Take an equal number of boys from the city, from circumstances as nearly equal as they can be found, and in the struggle for life and position, whether it be social, political or pecuniary, the boys from the farm will come out ahead. They may not, at first, appear so quick, so ready to adapt themselves to circumstances, or so accomplished for their age, but in the long run they will generally get the better of the boys from the city.

The greatest apparent disadvantage is in early education. The city boy seems, at first sight, to be highly and especially favored. He has what are called the best schools and the best teachers that money can procure. He is driven to learn, whether he will or no, and at the age of twelve or fifteen he will show greater readiness and proficiency in study, and be able to write better, and, perhaps, to read and speak better and with more self-possession before the school on exhibition and other days. But even here the advantage is rather apparent than real.

With a complete knowledge of the methods pursued, both in country and in city schools, and the most ample opportunities of comparison from a close observation of the results obtained in both, I should unhesitatingly give the preference to the country and to farm-life for a boy, no matter what his future is to be.

The city school is run on too high a pressure of competition, as much too high as the country school is too low. Of the two systems, of graded and ungraded schools, I am inclined to think the latter will show the better results when the

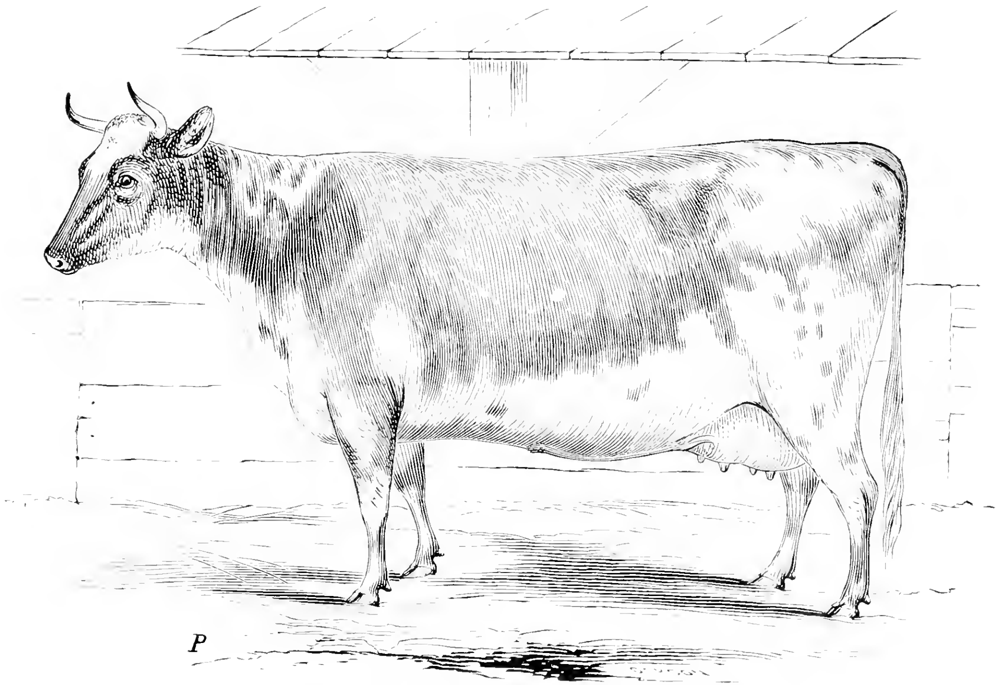
health and mental vigor of the pupil through life are considered. If a boy in the country school has any snap, any ambition and manliness in him, he can go ahead and work out his own destiny more freely and with greater energy. He will, in the end, accomplish more, if he has the elements of success in him. If he has not, no school will ever put them into him.

Let every farmer's boy, therefore, learn to appreciate the value of time; learn to feel that he is to be the architect of his own fortune; learn to cherish high aims and lofty purposes of self-culture, and learn to realize the fact that the farm will furnish ample scope for the growth and development of all the elements of a manly, high-toned and noble character.

CHARLES L. FLINT,

Secretary of the State Board of Agriculture.

BOSTON, January, 1874.



IMPORTED AYRSHIRE COW, "GEORGIE."

PROPERTY OF STURTEVANT BROS., "WAUSHAKUM FARM," SO. FRAMINGHAM, MASS.—See Preface to Second Part.

First Prize at N. Y. State Fair, Albany, 1873.

APPENDIX.

REPORTS OF DELEGATES

APPOINTED TO VISIT THE

AGRICULTURAL EXHIBITIONS.

ESSEX.

The subscriber highly enjoyed the second day of the renowned old Essex County cattle-show and fair. The Society migrates around the county, giving different sections and towns the advantage of its anniversary celebrations. I like the plan—or should—if the cattle and horses could carry their stables and sheds around with them, to protect them against foul weather.

This year the fair was held in Gloucester, on the rock-bound shore of the sea. A good exhibition of "fish" might have been expected here, but the shows of "flesh and fowl" were quite startling to a Berkshire man.

The fair being held in an extreme part of the county, it did not, of course, call out a fair exhibition of the live-stock of Essex. The moderate number of oxen, steers, bulls, cows and heifers that were on the grounds the second day, were good specimens of the various breeds. If oxen entered for premium were not numerous, the Society has a way of expanding the number which, to a backwoods Berkshire man, is quite novel and pleasant. They give the first premium to the *off-ox* and the second premium to the *near-ox*.

The poultry-show was surprising and highly gratifying to me. The coops of Brahmas, light and dark, the partridge and black Cochins, the Plymouth Rocks, the Dominiques, the Bantams, the Leghorns, the Bolton Grays, the great variety of beautiful ducks and geese,—made a musical and interesting little neighborhood in which I could have tarried contentedly a whole day.

I was much pleased with the work done at the ploughing-match. Although the field was not very favorable, the furrow was turned with a depth and thorough completeness that I do not often see in my own agricultural county.

The exhibition in the Town Hall was another surprise to me. Such an array of specimen fruits and vegetables, roots, seeds and flowers, would be highly creditable to any town, city, county or even country. To see my old pet pears, the Bartletts, the Flemish Beauties, the Belle Lucratives, grown up into such prodigious dimensions, made me doubt at first whether I was in California or old Essex. This field of the fruit, flower and esculent plant of the county might well repay the study of a student of nature for more than a single day.

The services in the church were of a useful character, and the whole day, enlivened as it was by the presence and civilities of friends, was a very pleasant one to me.

E. H. Kellogg.

MIDDLESEX.

The annual exhibition of this Society was held at Concord on the 23d and 24th of September.

Professor Agassiz, the appointed delegate of the Board, was present, as usual, at the post of duty, faithfully inspecting the several departments, and, with his wonted eloquence, addressing the members of the Society in words of kindly criticism, hearty congratulation and sound advice. But alas! before the time for the presentation of his official report arrived, this great teacher and inspirer of men was unexpectedly removed from the scenes of his earthly activity. The farmers of Middlesex will gratefully remember that, while enjoying a world-wide renown for genius and learning, he generously labored to encourage and strengthen all organizations and institutions designed for the advancement of agriculture and the diffusion of scientific knowledge among the people.

The following brief report of the fair has been prepared at the request of the secretary with the approval of the Board:—

This Society owns a fine tract of some twenty-five acres of level land, conveniently located near the depot of the Fitchburg Railroad. The half-mile trotting-course is well laid out, and furnished with the necessary structures for the convenience of judges and spectators. Covered sheds for stock are arranged near the fence, along a portion of two sides of the inclosure, and forty box-stalls afford excellent accommodations for horses.

The exhibition hall, erected at a cost of $16,000, is an exceedingly tasteful and commodious edifice, one hundred and thirty feet long by sixty wide, and two stories in height above the basement,

which is dry and well lighted. A handsome tower and a convenient balcony on the second floor are a great addition to the appearance of the building, and furnish a view of the entire grounds, near which flow the placid waters of the Concord River.

The officers of the Society, under the leadership of President John Cummings, of Woburn, evidently intend to provide every convenience and every suitable attraction for the use and enjoyment of the people when they come up to their annual festival. A plan has already been made for planting a large number of evergreen and other ornamental trees, in such a manner as to produce the most pleasing effect to the eye, and at the same time furnish desirable shade. The ground also is being continually improved and enriched, so as to secure a smooth surface well covered with a vigorous growth of grass, one of the most indispensable elements of a fine, rural landscape.

The weather was very unfavorable until about noon on the second day, and this, of course, largely reduced the attendance and the receipts. Nevertheless, several thousand spectators were assembled to witness the trotting, and a large number were present at the dinner which was served in the upper hall. The arrangements for this very important feature of the fair were most admirable. The tables were laid with an evident regard to appearance, and the food was well selected and well served. The quietness and order were such as would be expected in a private house, and are rarely observed on public occasions. After dinner, interesting addresses were made by President Cummings, Professor Agassiz, Ex-Governor Claflin, Hon. E. R. Hoar and others.

The articles in the lower hall were numerous, in nearly all departments, and were arranged in such a manner as to be convenient for inspection, and at the same time present a pleasing and effective appearance.

The vegetables were remarkable both for the excellence of the specimens and the distinctness of the varieties shown. The fruit was good, especially the pears and the grapes. Hon. E. W. Bull, the originator of the most valuable variety yet produced in this country—the Concord—exhibited a large number of seedlings, which he believes to be well worthy of cultivation. Captain J. B. Moore also was a large contributor of seedling-grapes, many of which certainly possess great merit.

Through the liberality of President Cummings, large premiums were offered for collections of wild and cultivated flowers and specimen plants in pots. The show was beautiful, but the finest plants were from the houses of the officers of the Society, showing that they practice as they preach.

There was a very interesting collection of several hundred species of native plants, some of which were in flower, some in fruit, and some in their gorgeous autumnal foliage. The bestowment of liberal premiums for such collections by all our societies would do much to promote the study of botany and to interest the people in the beauties and wonders of the world around them.

The exhibition of milch-cows was good, the prevailing breeds being Ayrshire, Jersey and Dutch, and their grades.

The ploughing-match was well contested by twenty teams, and twelve premiums were awarded.

The show of horses was very creditable in all classes. One of the best animals was a bright bay three years old stallion, of Gray Eagle stock, bred and owned by President Cummings.

The premiums awarded amounted to about $1,600, exclusive of the purses for trotting, which are raised by subscription. The evidences of wise management and enthusiastic interest in the objects of the Society on the part of its officers were everywhere manifest, and it would be of great advantage to the agriculture of the Commonwealth if the methods which here produce such desirable results could be more widely known and imitated.

W. S. Clark.

MIDDLESEX NORTH.

It appears by the records of this Board, that Dr. Horace P. Wakefield was assigned as delegate to the Middlesex North Society. Through his kindness I effected an exchange, remaining at home with the Middlesex North, and he visiting the Worcester West Society, to which I had been appointed as delegate.

The exhibition of the Middlesex North Agricultural Society was holden on Thursday and Friday, the 25th and 26th of September.

The forenoon of the first day was occupied in receiving articles for exhibition in the different departments. At twelve o'clock the entries were closed and the gates opened to receive visitors to the exhibition, and at two o'clock the meeting for the choice of officers was held.

A large amount of fruit was exhibited, apples occupying quite a large portion of one of the long tables in the hall. A very good display of grapes, consisting of the different varieties. The display of vegetables did honor to the exhibitors; especially noticeable were specimens of pumpkins raised upon the Rogers' farm in the city of Lowell, weighing between one and two hundred pounds each.

There was quite a large display of flowers; that of pot-plants by E. Shepard was excellent. An average show of farming implements and inventions. The show of household manufactures was quite large. A good display of cereals.

The display of horses, neat-stock, swine and sheep was fair. The show of poultry was larger than usual; among the many exhibitors were W. H. Eastman, of Stoneham, seventeen coops of fowls, and C. L. Parker, of Winchester, seventeen coops of fowls, all of which were of more than an average excellence. The display of pears was unusually attractive, embracing nearly all of the choice varieties. There were several contestants for superiority in the ploughing-match, the first premium being awarded to L. Phelps, of Lowell.

A prominent feature in the exhibition on the second day was the dinner given by the Society.

It is well known that this Society has in the two previous years exhibited in connection with the New England Society. Those who should have exhibited with this Society seemed to feel a timidity in competing with the professional breeders of the several New England States, and thus deprived the Society of some choice specimens of the products of their farms and herds. This was a mistaken idea, as they should have competed for the larger premiums offered by the New England Society, rather than allow them to be taken by persons living at a distance. The union was financially a success, and we hope that time will show it to have been agriculturally so.

The Society has some seventeen acres of land inclosed with a substantial board fence, an exhibition building some seventy by one hundred and ten feet long, two stories high and a basement, affording commodious apartments for exhibiting in the three stories; also about seventy-five stalls for the accommodation of horses and cattle, as well as sheds and like conveniences, and a superior half-mile track,—thus giving the Society a property for which at any time it could realize thirty thousand dollars, all of which is paid for, leaving the Society out of debt and with several hundred dollars in its treasury.

J. Ladd.

MIDDLESEX SOUTH.

On arriving at the Society's grounds, your delegate found matters in that chaotic state comprised in those oft-quoted words "getting ready," but everything betokened success when all *was* ready. Upon inspection of the cattle-pens and sheds (being a neat-stock fancy

man), his eye quickly detected the merits and beauty of the stock exhibited by Messrs. Bowditch, Burnett, Parker, Sturtevant, Taft and others, and it was noticeable that the most of them were merely for *exhibition*, no claim being made for premiums, thereby giving those of our agricultural friends who do not believe in "fancy farming" an opportunity to compete with full bloods and grades of *their* own raising. Your delegate was very much pleased to see this, as so much complaint has been made by the hard-handed yeomanry that it was no use for them to carry stock to fairs to compete with men who had money with which to buy the best, keep it six months, then sweep all the premiums; certainly the farmers connected with the "South Middlesex" cannot make that excuse for withholding their stock from the "fair," and your delegate takes this occasion to thank those public-spirited exhibitors of stock who, at so much trouble and expense, without hope of pecuniary return, added so greatly to the attractions of the fair.

In the hall matters were looking very promising; the beautiful display of green and hot house productions from Mr. Lewis added much to the beauty of the show; while the Messrs. Chadwick, with their one hundred and twenty-five varieties of vegetables, and eighty kinds of garden and vegetable seeds, with the display from the farm of Mr. Lewis and others, showed that the products of the farm in Framingham meant something beside stock and "agricultural horse-trots."

Your delegate very much regretted that he could not devote more time to inspection, but in his short but agreeable visit was much impressed with the thought, that, if interest and work by the president and associate officers of the Society can cause the "Middlesex South" to flourish, its success is assured, and the bounty of the State well applied.

JOHN A. HAWES.

WORCESTER WEST.

By your assignment. I was delegated to attend and report upon the Annual Fair and Exhibition of the Middlesex North Agricultural Society, holden at Lowell, September 25th and 26th; but for the accommodation of Major Ladd, a member of your Board, who was delegated to attend the Worcester County West Agricultural Society Fair, holden at Barre on the same days, I made an exchange with him, as he wished to be at home and attend the exhibition of his own Society, and consented to attend the Worcester County Fair, realizing that so much as Barre might lose Lowell would gain.

Your delegate did not arrive on the grounds till after the ploughing-match, but he found the ground well ploughed. Eight pairs of oxen and seven pairs of horses contested for the premiums. Six premiums were awarded for ploughing with oxen, and three for ploughing with horses. Conspicuous among the successful competitors in all this section of country, are the dwellers in Sutton and Charlton.

The entries of working-oxen were many, and there were ten successful contestants. In the main, the work was done well, and with but little use of the lash and less shouting. The steers were well broken, and their trainers showed that they knew what strict discipline was.

The fat oxen would do credit to any exhibition, showing that the region had good pasturage, that grain had been grown somewhere, that the oxen had found it, and that a steak from the round of these fat fellows would intensely excite the salivary glands of a good feeder any time between mid-day and three P. M.

There was a fair show of thoroughbred bulls,—Durham, Ayrshire and Jerseys, and premiums were awarded accordingly. There was only one herd of neat-stock entered for premium, a Jersey herd, entered by Rev. J. W. Mowry. To this was awarded a premium of ten dollars.

There was the best show of dairy-cows that I ever saw at any county or sub-county fair. There were thoroughbred beauties, Durhams, Ayrshires and Jerseys, that were worthy specimens of these distinguished and contesting breeds; and the milking-herds of Howland, Holland, Lane, Conant and Crawford, and the single cows of Brown, Bacon, Barret and Bridges would be *prima facie* evidence. if not absolute proof, that Barre and vicinity is a good butter and cheese producing section. And then the heifers that had come, and those coming, to milkhood, gave excellent promise that they would be worthy daughters of noble dames.

The show of poultry was good, but I cannot stop to particularize, for the time would fail me to tell of the Brahmas, the Dorkings, the Leghorns, the Spanish, the Game, the Polands, the Dunghills, and,—

> "The old white hen with yellow legs
> That laid her master many eggs."

On the grounds were carriages and buggies from the manufactories of Loring and Stone & Son; mowers, horse-rakes, agricultural and many other implements, showing the active genius of the inventive Yankee.

The hall was well filled with fruits, vegetables, needle-work, manufactured articles and works of art that did honor to the

industry and patience of those whose skilled fingers wrought so assiduously for the pleasure of all who came to see and enjoy their handiwork. The bread, butter and cheese exhibited by the ladies, gave proof positive that their cakes were not all dough, and that they could perform their part at the churn and the cheese-tub as well as the cows at the milk-pail.

Here were exhibited the apples of Messrs. Ellsworth and Carruth, the pears of Tyler and Earle and the grapes of Batchelder and Lane, so very tempting that I think it cost many of the fair Eves a mighty struggle to refrain from tasting the fruit forbidden by the placard, "hands off."

A pleasant feature of the occasion was the gathering from all classes of from three to four hundred persons in their new and commodious hall. Here, having gratified the appetite, and had a social chat with friends, the company were in a fitting mood to listen to eloquent remarks from the Hon. Alexander H. Rice, of Boston, and the Hon. George B. Loring, of Salem. These gentlemen spoke learnedly, agriculturally, gushingly, and well they might speak well, for they were well paid for their efforts on the spot, by the presentation to each from the ladies of Barre, of one of those magnificent cheeses which would last a man his life-time unless too many mice were nibbling at it, or too many hangers-on were moving round for a bite of the precious morsel.

By the report of the treasurer of the Society, it appears that the Society is in a prosperous condition, although during the year their hall, with all the personal property stored there, was destroyed by fire. The insurance companies which had issued policies on the building promptly paid their losses, and a new building has been erected, ninety-six feet long and forty-eight feet wide, with a projection thirty-six feet by fifteen.

Early morn of the 26th gave promise of a cloudy day, but as the sun came up the mists and clouds disappeared with the early dew, leaving us a day as lovely as could be desired. This was exclusively devoted to that noblest of animals, the horse. Stallions, draught-horses, matched horses, family horses and trotting-horses were all trotted out for exhibition, showing their pedigree, their blood, their training, their docility, their bottom and their speed.

Some thirty years ago, when I perambulated the hills of Barre and vicinity in a doctor's gig peddling pills,—when Ginery Twichell, since member of Congress, but now in the more honorable position of president of the Worcester County West Agricultural Society, used to collect and express the annual returns of the elections on horseback to the metropolis,—when Barre had as good facilities for communication with the rest of the world as any town in this

section of the State,—I remember attending an agricultural show, holden on Barre Common, and a dinner at the Barre tavern. The same sun shines in the same skies, the same streams meander through the same valleys, the same hills raise their brows to be laved by the same showers and kissed by the same breezes, the same propensity to get up and eat good dinners remains the same among the children as with the fathers in days of yore, but all else, how changed!

From a hamlet she has become almost a city; her brooks are made to turn a wheel for the manufacture of some gimcrack gotten up by a progressive Yankee to turn a penny on every waterfall; her fields are bronzed with yellow corn; her hill-sides are carpeted with the liveliest green; and improvement is stamped on her mansions, farm-houses, on her spacious barns, on her flocks and herds, on her crops and on her productions, mechanical as well as agricultural.

Perfection only is hoped for, with a fair prospect that this may be realized in the not distant future, since the ladies have just carried off two of the premiums for the best reports, which goes to show that where refinement, delicacy and genius enter into the contest, woman compared with man will always stand two to one.

HORACE P. WAKEFIELD.

WORCESTER NORTH.

The twenty-first exhibition of the Worcester North Agricultural Society was held on the Society's grounds, in Fitchburg, on Tuesday and Wednesday, September 24th and 25th, 1873. The weather during both days of the fair was lowery and threatening, which evidently affected the success of the exhibition and its financial returns.

On entering the grounds, my attention was at once attracted by Worcester Swan's pair of oxen, which weighed 7,000 pounds; and the pair of sleek cattle from Fitchburg town farm, which weighed 5,000 pounds.

There was a creditable show of neat-stock on the grounds, prominent among them being Messrs. Miles' and Whitman's herds.

There were sixty pairs of oxen and steers, eighty-five Durhams, and a goodly number of Devons and Jerseys. Of sheep there was a fair exhibit of five entries.

The show of swine was good; prominent among this class was a pig twenty-three months old, which weighed 1,038 pounds.

Of poultry there was a fine show of thirty entries. At a signal from the Fitchburg Band, which was on the grounds, the ploughing-match commenced at ten o'clock A. M. The work was well done considering the condition of the soil on which the trial was made. There was a fair show of agricultural implements of various kinds. In the hall was a creditable supply of vegetables ; flowers and fruits were in profusion.

The exhibition of harnesses was superb.

Of bread and canned fruits there were twenty-five entries of each ; twelve entries of butter, and four of cheese ; of apples there were 200 plates ; pears and grapes 100 plates each ; and there were some fine-looking peaches.

The most remarkable feature of the exhibition was the array of machinery, which was in full operation by steam-power. Your delegate thinks that Fitchburg takes the lead in this line of exhibition.

At one o'clock, the clambake, which had been in full preparation all the forenoon, was ready, and the tables were soon surrounded by about three hundred persons. The dinner over, speeches were in order, and Governor Washburn, followed by other speakers, made some interesting remarks on the occasion. The day's exercises closed with a little horse-trotting and a foot-race. On the second day there was an exhibition of horses in the morning, and a trial of draught-horses and oxen.

I am sorry to say that the finances of the Society exhibited a deficit at the close of the fair, the receipts at the gates being greatly diminished by the bad weather.

THOS. L. ALLIS.

WORCESTER SOUTH.

The morning of the 11th of September, 1873, witnessed the opening of the annual farmers' festivals of Massachusetts. It was the good fortune of your humble servant to be called to the Worcester South. The early morning promised anything but a pleasant day. The genial sun, as if in answer to the numerous prayers, soon dissipated the threatening clouds, and brought joy to thousands of anxious hearts. But the effect of the threatening was to prevent many from coming with their contributions, and consequently some of the departments were not filled to the satisfaction of the managers.

The ploughing was the first on the programme ; there was some ten or twelve entries. The ground was rather light, with a gravelly bot-

tom, filled with round stones, requiring a steady nerve and considerable skill to keep the plough in line. The work was well done considering, and a true test of workmanship. My attention was given more particularly to the boys' department, or I should say the young men, for they performed their work man-fashion. Marsh, of Sutton, twelve years of age, with Telegraph plough, No. 2; Doughty, of Charlton, eleven years of age, Nourse 73½ plough; McKinstry, of Southbridge, 15 years, plough Eagle 73½. It was a sight worth a journey of a hundred miles, and it is no wonder that the fathers and grandfathers were there to witness their triumph.

The exhibition of working-oxen and steers was the best I have ever witnessed; there were several town teams and several superior fat cattle on exhibition. The show of dairy-cows was not so extensive as I had expected from the beautiful farms passed on my way to the grounds. And if I should express my opinion as to the cause, I should give it as the fault of the Society, rather than that of the farmers. I sympathize fully with the Society in their anxiety to free themselves from debt. Still I think it false economy not to provide food for the stock while on the grounds. It is not always convenient or possible for the owners to bring their own fodder, and to drive cattle eight or ten miles and let them stand all day without food or shelter, and then drive them home again at night, might reasonably be construed as "cruelty to animals," and for dairy-cows especially it would be ruinous. In all kindness I would say, gentlemen, provide good food for the stock and shelter if possible, and you will find your interest in it; the farmers then will bring their best stock, and thousands will come to see them, and your profits will soon pay your debt. There were fine herds of Ayrshires, and good specimens of the Durham and Devon and their grades, and a promising show of young stock; of sheep, swine and poultry, but few were on exhibition.

The exhibition in the hall was commendable; the ladies' department was well filled with fine specimens of their handiwork. The photographic art was well illustrated, and some of the pictures were finished in the highest style of the art. There were handsome light carriages and harnesses, clothing, boots and shoes, and a thousand other articles worthy of notice. Flowers in almost every variety. The show of fruits and vegetables was not what we might expect; there were fine specimens of both, that showed their soil capable of producing both fruits and vegetables of the highest class under good cultivation. The butter and cheese and the domestic bread looked good enough to eat, and was rather tempting to a man who took an early breakfast and then rode eighteen miles in the country air. Fortunately the "dinner-horn" sounded just at this moment, and your

servant was aided to the lower hall, where the tables in long rows were heavily laden with the good things for the inner man. The effect was to make him forget that he was ever hungry or tempted.

While in this happy frame of mind, we were invited to the upper hall, to hear the address by Dr. Loring. It was one of his most happy efforts, and was well received. Then came the exhibition of the town teams, and then the exercise of the *trained steers*. To one who never witnessed this beautiful sight, no true conception could be formed. It is simply an exhibition of the wonderful power of the human mind in sympathy with animal instinct, or in other words the wonderful power of kindness.

There can be no doubt that man has the power to impress his own character on that of his domestic animals, that he can inspire them with love and confidence, or with hatred and revenge, and it re-acts on himself as certainly as it does on the animal. It has been said that "Every man is the builder of his own temple," "That any nobleness begins at once to refine a man's features, and any meanness or sensuality to imbrute them."

To educate our domestic animals through the agency of love instead of fear, to learn that they have sensibilities and affections like ourselves, is the great lesson of the hour. And this was the lesson taught by the training of these steers; and that this practice will prove as beneficial to these noble boys as to the animals themselves, I have no doubt. This spirit is the foundation of true manhood. This is a step in the right direction, to make our boys love their home, to love the farm and to respect themselves. Much has been said about our young men leaving the farm for other employments. I fear the fault is not always with the boys. May it not be the fault of the parents oftentimes? They too often forget that boys have manly feelings and aspirations, and if these are gratified at home there will be no incentive to go abroad. Let them once become interested, let them feel that their efforts are appreciated, that they are somebody, and all will be right.

The exhibition of the first day was purely agricultural, and, taken as a whole, was a success. The second day was devoted to the horse, and from report I learn that it was a great success, bringing together a greater number of spectators than ever before seen on the grounds at one time.

ELIPHALET STONE.

WORCESTER SOUTH-EAST.

The fourteenth annual exhibition of the Worcester South-east Agricultural Society was held on Tuesday and Wednesday, Septem-

ber 30th and October 1st, on their fair grounds in Milford, formerly the grounds of the Charles River Driving Park, now mostly owned by one individual. Through the kind invitation of Hon. Wm. Knowlton, we found ourselves in Upton on Monday, the day before the fair, and enjoyed his liberal hospitality. There are some men who are earnest in doing something to make their mark in the world. Mr. Knowlton is among that number, as is clearly shown by the beautiful village that is growing up around his extensive bonnet-shops.

The success that has attended his energy and skill in reclaiming swamps and improving the sterile soil of Upton's rocky hills, was seen at a glance as we hastily rode around the estate. We said to ourselves, and expressed it to our host, that such enterprise deserved a better locality to develop itself. Tuesday morning found us early on the way to the fair-grounds through a drizzling rain, which continued till near the time of commencing the programme of the day. In consequence, there was a small show of all kinds of stock. Jerseys, Ayrshires and their grades predominated among the cows and heifers. Not a large collection of working-oxen; but their training, shown on the plough, on the cart in drawing and backing-up grade in a true line, or in the ring by boy-experts, proved that the ox can learn to be useful to man, and about as intelligent as some of our own species.

Over thirty teams competed in the ploughing-match; the ploughing was well executed considering the condition of the soil.

The number of entries in some of the classes was as follows: Working-oxen, six; steers, eight; cows and heifers, ten; swine, twenty-one; breeding-mares and colts, twenty. In the hall, over two hundred plates of apples and pears, from fifteen contributors of apples and twenty-six of pears; with over thirty contributors in the vegetable department.

The show of fruits, flowers and vegetables and farm-products was large and fine, and superior to what might be expected from the sterile soil of the towns comprised in the limits of the Society.

The exhibition in the ladies' department was very fine, and pronounced a success. The show of butter was superior, the competition large, and from its looks one would pronounce it nearly all *gilt-edge*.

After the dinner, the second day, in the upper hall of the agricultural building, the address of Dr. Thomas M. Stone, of Wellfleet, on the subject of "Homoculture," or "True Cultivation of Manhood," was listened to by a large audience, who were not only instructed but highly interested.

H. M. Sessions.

HAMPSHIRE, FRANKLIN AND HAMPDEN.

I attended the show at Northampton on the second of October, and was received with great kindness by Mr. A. P. Peck, Mr. Graves, the local delegate to this Board, and by Mr. A. F. Judd, the president of the Society, to whom I was indebted for numerous favors and facilities to witness the exhibition. Located on its own grounds in the beautiful valley of the Connecticut, and within a mile of the most charming village in New England, I could not fail to enjoy all that met the eye. I was gratified to see that the farmers of the surrounding towns appeared to take a lively interest in the show, and exhibited their Shorthorns and grades, some of enormous size, which have been exhibited at other societies in the Valley. Here, as elsewhere throughout the State, the Jerseys have gained a foothold.

The Massachusetts Agricultural College presented a cattle-show in itself, and the animals attracted great attention, and were in fine condition. The following entries were made by the College: Seven milch-cows—three Shorthorn, two Ayrshire, one Jersey and one Devon; eleven heifers—five Durham, four Ayrshire, two Jersey; three bulls—Durham, Ayrshire and Alderney, and one bull calf, Durham; miscellaneous stock—three Devons, two Brittany, two Dutch; one Berkshire boar, two sows with pigs; turkeys, ducks, Cochin, Game, Houdan and Poland fowls; eight varieties fancy pigeons; horses—one stallion, two pairs draught-horses, one single draught-horse.

The exhibition of cattle was large, well managed and well attended, but I trust that some measures will be taken to exhibit them in pens, or in inclosed sheds outside the track, instead of tying them to the fence inside the ring.

The annual address was delivered by Prof. Parker, of the Agricultural College, and was replete with suggestions of science and common-sense with regard to the location, erection and arrangement of country dwellings.

With the exception of a noticeable want of method and arrangement for getting to the dinner, the exhibition was well conducted and an honor to the Society.

The show of fruit, especially of grapes, was very good, and the pears were better than I have ever noticed in the valley of the Connecticut.

CHAS. G. DAVIS.

HIGHLAND SOCIETY.

The pleasant duty assigned me by the Board, of inspecting the exhibition of the Highland Society, at Middlefield, on the 11th and 12th of September, was duly performed. The show, though very creditable as a whole, and well sustained in some of its parts, was not, perhaps, equal to some former years in the department of neat-stock and the universal interest of the farming community. The noticeable deficiency was in the number and variety of young animals and in oxen for the stall and work. Splendid specimens in these departments were on exhibition, and a sharp competition was developed in the working-class. Judged by the animals on the ground, and their products of butter and cheese in the hall, the members of this Society are awake to the importance of the dairy, skilful in rearing and selecting suitable animals for the purpose, as well as adepts in the manufacture of its products. The reputation of the farmers of that section for choice thoroughbreds and fine grades was well sustained by the exhibition, and the presence of several superior breeding-males, which were owned by members of the society, indicates a hopeful future for its stock interest. In the departments of sheep, swine, breeding-horses and poultry, the show was good, and gave evidence of systematic intelligent effort in the practical improvement of these animals. Mechanic arts, in the line of implements and machines to make agricultural labor more efficient and productive, were well represented, and attracted marked attention, but they as a general rule were produced out of the Society's limits. There was abundant evidence of the skill and interest of the community in the exhibition of fancy articles, domestic manufactures and household products, which give an inner view of the home-life, tastes and refinement of a people. The lack of that universal interest of the surrounding community in the operations of this Society seems to be the result of local jealousy, which will undoubtedly be ephemeral in its influence, and result in greater good for the whole. The Society still maintains in its anniversary the commendable feature of devoting the evening of its exhibition-day to public social enjoyment and the discussion of topics of interest to an agricultural community, making it an occasion of pleasure and improvement. Middlefield and the other towns embraced within the limits of the Highland Society are located on the highest and most inaccessible points of the Green Mountain range, and though rich in beautiful, picturesque and grand scenery, do not at the present time present a very inviting field for purely agricultural labor. The meagre deposit of soil which has been gathered in the cavities and uneven surfaces

of this rocky range, whether formed during the drift-period or by subsequent disintegration and abrasion, contains the minerals of the micaceous, talcose, hornblende and gneiss rocks. By decomposition, an aluminous soil was produced, possessing fair supplies of iron, soda, magnesia, lime and potash ; a soil which, in its primitive state, was adapted to the production of sweet, nutritious grasses, and making these hills and mountains good grazing-lands. But continued and persistent grazing without cultivation and manuring, the making and deportation of animal carcasses and products and the action of water on the slopes and steep hill-sides for a hundred years, has depleted the soil of the decomposed elements, and very materially depreciated its producing power. Such is the general configuration of this territory,—its broken, uneven and precipitous character,—the soil strewn with immovable bowlders and checkered with ledge-rocks, that it can be improved and brought back to a profitable state of fertility only by men of pluck, indomitable perseverance and possessing an accurate knowledge of the fundamental principles of soil-change and plant-growth. By observation and inquiry, I am satisfied that such men are there, and at work, and that this agricultural society is stimulating and encouraging them in their arduous labors. Whatever may be the condition of agriculture and agricultural societies in the more favored portions of the Commonwealth, the farmers on the mountains deserve, and the best interests of the State require, that they and the societies that give them support and encouragement should continue to receive its fostering care.

LEVI STOCKBRIDGE.

HAMPDEN COUNTY.

The Hampden County fair was held at Springfield, October 7th and 8th, on the grounds of the Hampden Park Association, in that city. The first day was so inclement that no exhibition could be held, and in consequence the exercises were crowded into one day. The display of cattle was highly creditable, there being the herds of Ayrshires and Devons so wel known in that section of the State, and excellent specimens of Shorthorns. The cold wind which had taken the place of the rainstorm was not conducive to the good appearance of the animals exposed to it, but they gave evidence of having been well-cared for, both in the pasture and the stall, and they indicated good judgment in selection on the part of the owners. The exhibition of carriage and draught horses was excellent, and the display of poultry indicated a large and judicious interest in this branch of agriculture.

The exhibition in the hall was very creditable. The western third of the hall was given up to pure agriculture, and here vegetables of every kind stretched in long rows three times up and down the hall. The north-western corner was occupied by an agent of the Burlington and Missouri River Railroad, who made a very complete showing of what the land along the line of the road can produce. A case of the freshest-looking bread and sweetest butter stood near by, to make hungry men more hungry, and tempt those without any appetites. In the south-western corner, Bagg & Batchelder made a fine display of their agricultural wares, while the space in front of the stage was well filled by Milton, Bradley & Co.'s innumerable toys, and an elegant case of pot-wear from O. D. Morse & Co. The most showy table was the double one through the centre of the hall, and the most showy display upon it was by the art-store, which had piled a pyramid of its treasures in the centre of the eastern half. The art-treasures were flanked on one side by an exhibition of furnishing goods by D. H. Brigham & Co., and on the other by Clark W. Bryan's specimens of bookbinding, which monopolized the rest of that side and the whole of the northern end. The whole of the western side, with the northern end, was given up to a fine display of fruit. The rest, or east side, of the hall was filled with fancy articles and some fine specimens of the new Wheeler & Wilson Improved Sewing-machines.

The closing exercises of the exhibition were an address by Commissioner Laisun, which was filled with useful and interesting information upon the details of agriculture in China, and a dinner at Cooley's Hotel, which was enlivened by suggestive speeches from many intelligent gentlemen.

For the consideration of this Society and the agricultural community generally, your delegate prepared and submitted the following view of

The Prosperity of Agriculture in Massachusetts.

The curious and indescribable charm which surrounds agriculture, even in the minds of those who know but little of its processes, and still less of its scientific laws, is remarkable and interesting. This may undoubtedly be attributed to the fact, that man's love of nature is one of his foremost sentiments, next to his love of kindred and home; and also to the peculiar radiance of all the bright days which dawn upon a farmer's life, and all the cheerful events which surround his occupation. Man's pathway through the world is not always pleasant and easy. Perhaps, as in nature, the darkness of night and the shadow of the cloud occupy by far the larger portion of passing time, leaving for the sunshine a smaller share, so in human

life the weary and heavy hours abound. But, while even the sorrows prevail, the memory of the bright and joyous days will remain, and they will cast their cheering rays through all the darkness. There is no such thing in all God's creation as unmitigated gloom. And so, around every condition and calling in life, the bright days will gather, the remembrance of which makes life dear to all men. Where, then, does the sun shine brightest? Where do the most delightful associations cluster? Where do the sweetest memories throng? Not where man, with his artificial ways, is supreme, but where he divides his power with nature, and submits to her influence one-half his life. The morning may dawn brightly on him who pursues his way to his mill or his office, but with what surpassing radiance it breaks for him who in the early sunlight walks a-field, and who, even in the midst of his toil, feels the sudden, and perhaps momentary, sense of awe and inspiration and freedom and joy, with which nature fills the souls of all her sons, and from which the dullest and most material cannot always escape. A resplendent sunrise over one's native hill, once seen and realized, do you think it is ever forgotten? Never! But all down the long and tiresome journey, even to the close, will that ray of morning beauty stream and eradiate many an hour which, but for that God-given picture, might be unsupportable in its gloom. The associations, too, of the field and the fireside, how they endear! And as the festal and anniversary days come round, where on all the earth do they mean so much as they do to him who, gathering his generations about him, points to the fruits of his copartnership with nature, and traverses those lands which were his father's, and which he intends shall be his son's? It is because the bright days of the farm are the brightest given to man in all his occupations, that the charms of nature are always recognized; and its fascinations are felt even by the weary farmer, who, when worn with toil for his land and animals, loves them still; and also by the poet, who knows and feels what beauty and truth God has written on the face of earth and sky.

And yet, triumphant as agriculture is, and will be, over the affections of all men, it is by no means successful in subduing their reason and judgment into a true recognition of its power and importance. It requires more defenders than all other occupations beside. The value of a farm all men doubt, and it has become almost the universal and accepted doctrine, that agriculture is a failure, and that agricultural regions, in New England at least, are in a hopeless decline. The important relations which agriculture held with the early prosperity and power of our country are forgotten. The fact, that even to-day, but for its abundant and superfluous products, our country would be plunged into permanent and hopeless bankruptcy,

nstead of being swept by a temporary and passing gale, seems to be entirely lost sight of. But whenever facts can be gathered which seem to prove that farms are decaying, that the profits of agriculture are small and unsatisfactory, and that the agricultural mind is obtuse, and the agricultural purse is empty, these facts are magnified and paraded with an air of triumph and satisfaction, which legitimately belong only to those who are removing a great wrong or abating a great nuisance.

Now, to a calm and fair observer, agriculture is neither unsuccessful nor declining. It is a many-sided occupation, not easily destroyed. Its channels are numerous. Its opportunities are various, and its energies should be equal to its opportunities. The closing of one channel is but a signal for the opening of another, and suppressed at one spring-head it will break forth in newer fields, like the sacred fountain of the fabled Arethusa. If any man supposes, either for the confirmation of a theory or the gratification of a prejudice, that the great tree is dying because a single branch has withered and perished, he will find himself, when perhaps he least expects it, enjoying the blessings of that generous shelter and shade.

The county of Essex perhaps affords as good an illustration as can be found of the readiness with which agriculture adapts itself to attendant circumstances, and finds prosperity in one way if it cannot find it in another. Time was when the farmer of this county was devoted to the production of all those crops which enter into the general business of agriculture. Beef was raised on his pastures and fattened in his stalls, on corn of his own raising. Hay and potatoes were his staple crops. The dairy of the county was quite distinguished for its butter and cheese. The prosperity of agriculture was undoubted. But as time went on a change took place, which can be well set forth in the following figures, indicating the comparative condition of agriculture in that county in the two periods of 1860 and 1870:—

	1860.	1870.
Number of cows, ...	10,425	9,076
Number of oxen, ...	3,585	2,319
Number of swine, ...	5,787	4,938
Amount of corn, bushels, ...	153,355	94,233
Amount of butter, pounds, ...	440,340	335,835
Amount of cheese, pounds, ...	50,532	22,782
Amount of hay, tons, ...	56,833	50,299

These figures are somewhat discouraging, but they tell only one-half the story. For while the amount of corn and hay and butter and cheese has declined, and the number of oxen and

cows in the county has diminished, the growth of market-garden crops has largely increased. The value of the market-gardening in 1860, was $175,000; in 1870, it was nearly $400,000. Now, what does all this prove? Not that agriculture is declining, but that an acre of onions or cabbages is worth more than an acre of corn or grass; that it is more profitable to supply the market with milk than with butter and cheese. To specific crops, then, has the county turned its attention; and never in its history has the soil of the county been a source of more profit to the owner than it is to-day. All around the great centres of trade and industry,—Lawrence, Haverhill, Salem, Lynn, Newburyport, and Gloucester,—the farmers are prosperous, and everywhere the farm-houses present an air of neatness and comfort, and the fields indicate a prosperous application of agricultural skill.

In no occupation, moreover, is labor more amply rewarded. Whether engaged in cultivating his own acres, or in toiling on the acres of his employer, the laborer is as amply compensated here by agriculture, as by any other service in which he employs the strength of his arms and the skill of his fingers. Of this capacity of the soil to remunerate those who devote their energies to it, I have at least one admirable illustration. I am officially connected with the Plumer Farm School in Salem. We have there thirty boys, committed for various offences, and whose labor is applied, a few hours every day, to furnish the institution a portion of its support. These boys are employed on the land, in producing market-garden crops and small fruits; and in the shop in manufacturing the seats of chairs—what is called "bottoming chairs." An accurate account is kept of the amount they earn per day in each of these occupations; and it is found that while in the shop they earn but twenty cents, on the land they earn fifty cents for the hours in which they labor. This is no theory, but a fact established after the fruits of their labor have been placed upon the market, and the proceeds in money have been received. The land always rewards liberally those who judiciously devote their energies to it; and the capitalists of the West are the great grain and beef growers of that region, and among the prosperous men of the East, are those who judiciously and skilfully and economically devote their farms to special crops properly cultivated.

But we are constantly told that the farming towns of Massachusetts are declining, and must ultimately die out; and this is so zealously repeated that it almost seems as if the position was assumed and defended to gratify a desire, rather than to state a fact or to sustain a theory. A slight reduction in the population of some of them, during a decade of war and manufactures, is adduced as proof

of their enfeebled condition. Now, loss of population alone does not indicate decay, unless it is carried so far that the industry of the locality begins to suffer. The general condition of the industry itself, and the prosperity of the population which remains, should not be lost sight of. I could name one city in this Commonwealth which lost in the last decade, nearly eight hundred of its population, and yet no one would pretend to say that its aggregate wealth is diminishing, or that its industries are declining. It lost a margin, easily affected by a local accident, and not involving its vital force. And so with regard to our farming towns. So long as the farms themselves maintain an air of thrift and the farmers subsist comfortably, with means enough to supply themselves and their families with what they need and desire, the question of population, except as a matter of depopulation, is secondary. There is a group of towns in Franklin County, for instance, in which agriculture is especially vigorous, and where the market for commercial fertilizers is always lively for the cultivation of tobacco and special crops, but whose population has been reduced in number from a loss of two in some instances, to more than one hundred in others, since 1860. There is no doubt that the wealth of these towns is increasing. If the agricultural resources of a few square miles are as well developed by five hundred persons as by six hundred, and five hundred can produce all that the region is adapted to, why should we desire to crowd those acres with a greater multitude? A surplus of population in an agricultural section has always been relieved in this country by emigration, or by calls to a new employment, and will be, so long as we have a great unoccupied West, and increasing manufactories, combined with popular energy enough to move. And as time goes on, and our active industries increase, we find an excess of population here, whether in city or country, more and more ready to seek relief. Formerly this excess was disposed somewhat to remain, especially in the rural districts; now it is disposed to go as rapidly as possible. It flies to the cities or to newer sections of the country,—not always, however, leaving a declining agriculture behind, as the towns I have referred to will testify. Besides which, we should remember that inasmuch as the arbitrary lines which divide towns do not control the currents of population, it is but fair that the aggregate development of an industry in a State should be taken as an index of its precise condition, and not the state of affairs in a single circumscribed locality.

But as population is made by many a test of prosperity in our agricultural towns, it may be well for those who see in the industry of such towns no signs of decay to accept the test, and ascertain, if possible, precisely what it means. That there are towns remote

from local markets, and without railroad accommodation, which do not enjoy a large share of the great and active prosperity of the times, there can be no doubt; but that even they feel the stimulating influences of the busy community of which they form a part there is also no doubt. They still live, waiting for a nearer approach of those activities which surround them, and which have found a foothold with their more fortunate neighbors. But the cases of decline, even in such towns as those which are called purely agricultural, if any such exist in Massachusetts, are the exception and not the rule. And while there are a few towns which do not sustain themselves, and where neither the natural increase nor immigration is sufficient to keep up the population, there are very many towns whose agricultural wealth and population do increase, on account of their proximity to the market and the energy of their agricultural communities. The census of 1870 shows, not only that other towns than those devoted to agriculture have decreased in population, but also that all such towns have not decreased, and that the *agricultural regions* by no means decay. The towns in Massachusetts which have decreased in population since 1860 are all those in Barnstable County, except Provincetown, 8 in Berkshire, 4 in Bristol, 9 in Essex, 15 in Franklin, 11 in Hampden, 12 in Hampshire, 15 in Middlesex, 2 in Norfolk, 15 in Plymouth, 23 in Worcester. Now, these towns are not all strictly agricultural. The towns on Cape Cod whose population is gradually decreasing have not a large farming interest, but are devoted principally to commerce and the fisheries, agriculture being in all of them a matter of secondary consideration. Other towns have been reduced by causes peculiar to themselves. Barre, for instance, was deprived of a large manufacturing population just previous to the taking of the census of 1870, by the destruction of its mills by a flood. The changes in such towns as Bridgewater are due to the floating character of that population which is engaged in the mechanic arts. Large numbers of the towns enumerated were reduced in population by the war, which took place between the years 1860 and 1870, many of their young men dying in the service, and many more finding occupation elsewhere after joining the army. In most of the remaining towns where a reduction has taken place, it has not been sufficient to affect the industry of agriculture or to reduce the amount of the crops. In most instances the farms still hold their own, and the farm-houses are in good condition.

Leaving now the towns which are really laboring under adverse circumstances, such as remoteness from market, and, perhaps a soil not of the best quality, and turning to those in which agriculture enjoys all the advantages which Massachusetts can bestow, we find affairs so highly encouraging that they can be contemplated with

pleasure by all who are interested in the occupation of the farmer and desire to see him prosper. The towns which lie around the centres of trade, and find in them the markets for their agricultural products share the general prosperity of the Commonwealth. The farming towns around the city of Worcester, even those in which manufactures have not been established, are thriving and prosperous. The same is true of those clusters of which Springfield, Pittsfield, Fall River, New Bedford, Taunton, Fitchburg, Lowell, all the cities of Essex County, and the large towns everywhere, are the centre and attraction. In such localities as these, not only are the old farms prosperous, but the newly occupied lands yield an ample reward to the cultivator. This is the thriving agriculture of the State; just as legitimate, and entitled to just as much consideration, as that more general mode of farming which occupies broader lands, and finds its market at a greater distance. It is that thriving and systematic agriculture which will be found in all the towns now supposed to be decaying, whenever they shall have their locality developed by the diverse industry which characterizes the State generally, or shall be brought nearer to a market by convenient and economical communication. It is that system of agriculture which is already attracting the attention of a large industrial class, whose service in our manufacturing establishments is counted of great value, and whose hard work upon the land is already teaching us the lesson that prosperity for our laboring-classes is not confined to our mills alone. It is no argument against agriculture to say that the cultivation of the staple does not succeed in Massachusetts. It is simply a statement which should teach us what agriculture is applicable here, and what is not; and we may be assured that if those who now occupy our soil will not learn this lesson, there are those who have learned it, and now stand ready to apply it, the instant an opportunity is offered. The farming-lands of Massachusetts will not be abandoned. They possess attractions still, which will be recognized by some one, as long as the industry of this State shall endure. The tendency of agricultural development here is not towards the system of those towns which have paused, but towards that of those which are progressing. It is the latter which are to triumph in the end, as their system is extended throughout the State, and as their example is followed.

The population of Massachusetts is now nearly a million and a half, supported by almost every industry with which man is familiar. Not everywhere, it is true, does every industry prosper. It is a fortunate combination that succeeds, and that should succeed, and it is a proper understanding of their mutual relations which gives strength to each. That prosperity which has increased the population of the

State from 1,221,432 in 1860, to 1,443,156 in 1870, will not be bounded by the lines of counties or towns, and when it occupies the entire Commonwealth, as it one day will, then we shall see that the agriculture which belongs to a people of diversified industry will be recognized as a prosperous calling in every town. Give all the towns the privileges which are enjoyed by those whose locality and circumstances are fortunate, and they will not only retain what agriculture and population they now have, but they will receive the additional population which always goes with the introduction of manufactures and the mechanic arts, and the additional agriculture which a manufacturing people require for their subsistence and health.

In connection with this agricultural prosperity, which is peculiar to every community like that of Massachusetts, there go certain rights and privileges which give great vitality to a people, and develop that independence and individuality of character, which belong especially to a free agricultural population, and which should not be lost sight of in comparing the agriculture of America with that of any other nation of the earth.

Geo. B. Loring.

HAMPDEN EAST.

The annual exhibition of the Hampden East Society was held in Palmer, on the 14th and 15th of October.

The season was so far advanced, we feared that it might detract from the interest in this fair. It was in a measure compensated for by the beautiful weather. The sweet autumn days, and the hills around clothed in golden colors, glowed in the sunshine with surpassing beauty, and all nature seemed to invite men to a grand holiday.

The officers of the Society welcomed us, and sought to give us an opportunity to make a fair estimate of the position of the Society, and the benefits which are resulting from it. There appeared to be an increased interest in the exhibition, as shown by the number of entries made for premiums over that of the last year, and hence we inferred it might be doing a good work in that community.

The show of cattle was very fair. The State Primary School at Monson, through its energetic superintendent, Dr. H. P. Wakefield, made by far the largest display of any one establishment, having some score and a half of animals on the ground. Its herd of milch-cows was evidently selected with skill or bred with great care, mostly grades of Ayrshire; they presented very fine points. The record of their milk-producing qualities vindicates the encomiums

passed upon the herd. Other herds might be mentioned as worthy of notice. In most of them, the grade Durhams seemed to predominate. There was also some good native stock scattered among the improved breeds. The display of oxen was not very large, but with some twenty entries of steers for premiums as workers, the prospect for the future is good for a better display.

One unusual feature appeared in the entries for ploughing, as there were but four contestants with oxen to eight with horses. We trust this is an indication of the better appreciation of the horse as a working animal on our farms, and the beginning of an era which will demand a breed of horses with docility, strength and the necessary activity for the various duties of our farms.

The skill in ploughing showed the most commendable care on the part of the farmers, as the ground was somewhat difficult to plough well with such numbers of cobble-stones under the sod.

We were also pleased, as at other shows in the State, to see the perfection of training exhibited by cattle, where the proper time and skill had been bestowed. Undoubtedly there is a difference of intelligence manifested by different pairs of oxen; but we see no reason why, with a very little more time spent in breaking the steers, the most of our working-cattle may not show the same proficiency. We only regret that for the want of that training, so many awkward and patience-trying oxen must be used. Kindness, preseverance, patience and good temper,—virtues cultivated in breaking steers,—would benefit both man and beast, making well-trained and intelligent oxen the rule, and not as now, the rare exceptions. Looking to this end, we most heartily rejoice in this part of our cattle-shows now so common.

The exhibition in the hall was in some respects quite fine. We were glad to find such excellent butter and cheese, and in sufficient quantity to show the dairy still occupied a high place in the estimation of the farmers and their wives. The vegetables and cereals were also there in full measure. The secretary remarked as an evidence of increased interest on the part of the people, that there were seventy-seven exhibitors of vegetables this year, against twenty-seven last year. The quality showed, also, that the farmers of this vicinity are fully alive to the best varieties, and are skilled in the production of them.

Pears and apples were scarce, grapes more abundant, and native wines of various vintages and qualities claimed more than a passing notice from committee and spectators. Fancy articles were there also in abundance. We find in all these exhibitions, that the women are ever ready to contribute their share of labor to keep up the interest in all these institutions.

The address of Dr. Wakefield (read on account of the Doctor's indisposition by Chaplain Foster) was a most direct and encouraging appeal to the farmers to stand by their position, and by an intelligent use of opportunities to make their calling remunerative, and to challenge respect by the neatness of their homes and the urbanity with which they presided over them.

We were informed that this Society is endeavoring to encourage the raising of horses by offering no premiums where speed alone governs the award.

The officers of the Society, and those most deeply interested in its success, are evidently working hard to make it what it should be, and certainly are encouraged by an increasing interest in the community where it is located.

William Knowlton.

DEERFIELD VALLEY.

The third annual exhibition of the Deerfield Valley Agricultural Society was held at Charlemont, September 30th and October 1st. I arrived the previous evening in a drenching rain, and feared it would dampen the ardor of the farming community and others in their preparations for the fair. The following morning was bright and clear, and as I made my way among the herds and vehicles which seemed to crowd upon each other up a steep ascent among the hills, I wondered where a spot could be found suitable for the exhibition. But I was soon ushered through the gateway, when my eyes fell upon as beautiful and level a plot of ground as any society could desire. It seemed as though nature had made a special effort to prepare this place for just this purpose. The surrounding mountain scenery was beautiful to behold. My attention was next called to the exhibition.

This Society, although an infant in years, is mature in its growth and management, showing conclusively the enterprise of the people. I was told, that at the first show, two years ago, there was no thoroughbred stock on the ground. But this year there were many herds of valuable and very fine thoroughbred animals. The show of oxen particularly attracted my attention. Over one hundred yoke of oxen were on the ground, and as fine a display as I have ever witnessed. I noticed one pair of oxen, belonging to D. O. Fisk, of Shelburne, that weighed 4,550 pounds. Another pair belonging to N. H. Harris, of Coleraine, that weighed 4,340 pounds. There were many others which I might enumerate of stately and symmetrical proportions, and which would do honor to any show. There were some

very fine three years old steers. Dennis Wilson, of Coleraine, showed a pair weighing 3,300 pounds; W. H. Hunt, of Heath, a pair weighing 2,940 pounds; E. Bemont, of Buckland, a pair weighing 2,900 pounds; and L. Brown, of Shelburne, a pair weighing 3,130 pounds. S. Dodge & Son, of Hawley, had three very fine yoke, which would do credit to any show. I might enumerate many others, but suffice it to say, that the show in this department was very fine. I noticed one pair of two years old steers, entered by J. O. Davenport, splendidly matched, and weighing 2,820 pounds. Also a pair by Dennis Canedy, of Heath, that weighed 2,780. The last-mentioned pair gained by pasture in four and a half months 506 pounds.

More herds of cattle were seen than are usually exhibited. At the head of these stood the herd of Shorthorns, thirty-eight in number, owned by G. P. and W. W. Carpenter, of Shelburne. It is seldom that we see a better herd throughout. D. O. Fisk, of Shelburne, had many fine animals on the ground. S. W. Hall, of Greenfield, showed a fine herd of Devons, the only stock I noticed of this breed, except a pair of oxen. There was quite a sprinkling of the Jerseys, evidently showing that this breed is gaining favor. The show of cows was not large, and no very astounding reports of large quantities of milk. One cow was reported to give during the month of June forty-seven pounds of milk per day. Another forty-four pounds. This is a good quantity for any cow to give, but not so large as many I have seen reported. I must not omit to mention J. S. Grinnell's black Kerries, remarkable for their size on the descending scale. Also a remarkable heifer owned by Henry Basset, of Charlemont, that produced four calves at one birth. Three of them died. The other one on exhibition, although it was several weeks old and weighed only thirty pounds, was one of the biggest shows I saw.

An interesting feature of the show was the trained oxen: and what attracted my attention in particular, was a small lad with a pair of steers seven months old attached to a two-wheeled vehicle, on which he sat perfectly at ease and giving his orders orally or by gestures, and which seemed to be obeyed as perfectly as soldiers at a military review. There was another pair that performed under the marshalship of Albert White, of Rowe, and which showed remarkable intelligence.

The exhibition of sheep was large; I think fourteen or fifteen pens were filled with them. Some of them were fine-wooled, but the larger part were of the middle or coarse-wooled sheep. This shows that there are localities in Massachusetts where sheep are not entirely discarded. The show of swine was fair, although the numbers were not large. The poultry show was meagre, except in the hen line, which was quite good.

On visiting the hall, my first, second and last impression was, that there would be a necessity for enlarging its dimensions or curtailing the products exhibited. It was so full of the products of the field, garden, orchard, products of the dairy, manufactures, and skill and workmanship of the ladies, that there was really very little room left. Considering the small amount of fruit grown the past season, the show was good. E. Jillson, of Charlemont, had seventy-eight varieties of apples; A. H. Abbot, of Buckland, fifty; Henry Bassett, of Charlemont, sixty-five; and G. H. Stewart, of Coleraine, twenty-eight. E. H. Judd, of South Hadley, had a fine collection of pears, as well as many others within the limits of the Society. In looking at the bread, butter and cheese, which looked so nice, I wondered if the committee would get all the specimens in the right place.

The address, which was on the programme for two o'clock, was delivered at twelve, by Leander Wetherell, Esq., of Boston. His subject was, "Then and now, or farming as it was thirty years ago and as it is now." It was interesting and instructive. He was followed by his Excellency Governor Washburn. He spoke very encouragingly of agriculture, placing it in the foreground of the picture among other industries. He alluded to the financial panic, and said he wanted the farmers to feel that, if they were not made as suddenly rich as some classes, they were not made as suddenly poor. Several other distinguished gentlemen were upon the platform, but as there was no further time for speaking the president said he would like to introduce them. He accordingly introduced Hon. Charles Adams, Jr., state treasurer, Hon. Charles Endicott, state auditor, and George W. Curtis, Esq., editor of "Harper's Weekly."

Dinner was now served by the Society in the basement of the hall, to the satisfaction, I trust, of all. The second day was devoted entirely to horses. It was impossible for me to remain, but I was informed that the crowd of people was larger than on the first day, and that the show was in advance of any former one. One hundred and thirty horses and colts were entered. The premium list shows that this Society do not intend that horses, nearly worthless for other purposes, except to get around the track in the shortest time possible, shall bear off the prizes, but that all the good qualities shall be requisite. There was nothing noisy or boisterous on the ground, but everything systematized to this one purpose—success—which was attained.

N. S. Hubbard.

UNION.

The eighth annual show of the Union Agricultural Society was held at Blandford, on the grounds of the Society, Sept. 18th and 19th. These grounds are located in the centre, near the church, on nearly the highest land in Hampden County.

The exhibition of working-oxen was the leading feature of the day. Great interest was manifested, and the time allowed was extended long after the hour for the annual address. The oxen were required to draw a boat loaded with stone, the oldest class drawing 4,300 pounds, and in one case the driver riding himself. In order to even start this load, they were obliged to exert themselves to their utmost capacity; and those that had been trained to it had the advantage; though of less weight, they accomplished it apparently easier than those of larger weight. There were over fifty entries of working-oxen. whose average weight was 3,000 pounds; one pair weighing 4,405 pounds. Upon inquiry we found that nearly all these had been bought in; very few are now raised in this section. This is not as it should be. Of the thoroughbreds, the Durhams, Ayrshire, Jersey and Hereford, had a few representatives; the Ayrshire taking the lead in regard to numbers. One lot of sheep, four of swine, and a number of coops of poultry, completed the list.

The exhibition in the hall was very fine; fruits and flowers, grain and vegetables, home-manufactured goods, fancy articles, and needle-work of all kinds loaded the tables. The fine samples of bread and butter, cheese and sugar, showed truly that we were in a land *flowing* with milk and honey, and *full* of the staff of life. One commendable feature of the fair, was the well-served dinners in the lower hall; the Society taking the whole responsibility of feeding the crowd, and turning the profits into their treasury. The address in the church, by Henry E. Knox, Esq., closed the exercises of the day. Mr. Knox is a lawyer in New York, and has purchased the old homestead in this his native town as a summer resort.

His address consisted of a very graphic description of a trip across the Continent to California, what he saw, etc. The only regret of the audience was that the closing hour came too soon. The great sale of Shorthorns in Central New York, the stock-yards of Chicago, the grain-fields of the West and of California, the many natural features of the country, and the different valleys of California,—all received a passing notice.

An interesting farmers' meeting was held in the church in the evening.

The rain the second day was too much for the crowd, though the programme of the day was put through by the efficient officers of this live Society.

H. M. SESSIONS.

FRANKLIN.

It is admitted that this was the best show of stock, of fruit, flowers, vegetables and fancy goods ever given in the county, and its secretary says that its members may well feel proud of, and well satisfied with, the exhibition upon the grounds and in Washington Hall. Two of the finest of New England autumn days—and what can be more beautiful?—were vouchsafed to us, an offset to the two dismal days of the fair of 1872; and a determination by some of the trustees, whose services should be remembered, to give some time and labor for the success of the fair, and the efforts of the executive officers, brought out an exhibition of stock worthy the good name and reputation of Franklin County and of the Society. Three hundred and thirty-seven head of cattle were entered under the class of herds alone, and such stock, too, as other societies are glad to borrow for their fairs.

In one particular of the fair, the farmers of Franklin County may well take pride, and that is, that while the show of stock was acknowledged never to have been excelled, not one-half was owned outside the county limits, nor by other than members of the Society. So also of the sheep, and also of the horses, with one exception. It was wholly, as the name of the Society indicates, a *Franklin County* fair.

The Society is also to be congratulated that, of the one hundred and sixty of the horse kind entered for competition at their exhibition, so many were really fine animals, and it is to be regretted that some who might add much interest to this department of the show allow their grievances to keep them from exhibiting their stock; let them exhibit, trusting to a change of policy on the part of the Society.

The exhibition in the hall was acknowledged to excel, as a whole, the efforts of any former year. It was the crowning success of the fair, and called forth the wonder and admiration of all who visited it. Not only the abundance of the contributions in every department, but the good taste and harmony in the arrangement was the marvel of everybody. The fine exhibition of Western productions, soils, &c., made by the Burlington and Missouri River Railroad Company, attracted great interest and attention, and will be the means of directing many of our young men whose faces are turning westward to their rich prairie-lands. Although the season was a

poor one for apples, no one would have suspected it who saw the fine display of fruit in the hall. Great credit is due to those who, at so much abor and expense, prepare fruit for exhibition.

The thanks of the Society are due to Whitney L. Warner for the energy and taste he displayed in arranging the numerous articles in the hall; also to F. G. Smith, superintendent of stock, G. P. Carpenter, superintendent of horses, Samuel J. Lyons, marshal, and their assistants, for the efficient and gentlemanly manner in which they performed their arduous duties; also to A. K. Warner, superintendent of grounds.

The exercises at the dinner of the Society at the Mansion House were of more than ordinary interest. The address was at the Unitarian church. President Crafts presided on the occasion, and, after a prayer by Rev. F. A. Warfield, introduced Hon. Geo. T. Davis as the orator of the day. The address, sparkling with wit and pleasant anecdotes, was quite in contrast to the usual stereotyped agricultural orations, and was listened to with the closest attention.

The Franklin Farmer's Institute held several interesting meetings during the fall and spring, and much desirable information was disseminated among its members.

During the year there have been added to the list of life-members the names of forty-three males and seven females.

S. B. Phinney.

BERKSHIRE.

As substitute for Capt. Miles, I attended the sixty-fourth annual fair of the Berkshire Society. It was held on the beautiful and convenient grounds of the Society at Pittsfield, October 7th, 8th, and 9th.

The weather on the opening day, which is the cattle-show, was all that was *not* desirable for such an occasion. The rain fell in torrents, and the accompanying breezes were neither gentle nor bland. Nevertheless, the farmers brought out their stock in great numbers, and the various premiums were duly awarded, and paid, as the custom is, in solid silver.

Considering the importance of the dairy-interest in the county, the number of breeders of thoroughbred stock appears to be quite small. There were on exhibition thirteen Shorthorn animals, six Devons, nine Ayrshires, ten Jerseys and four Dutch. The native and grade cows were numerous and excellent.

There were a few Southdown sheep, but no swine of any particular breed. The horses numbered 134 in all classes, and were

generally good, serviceable animals, but few were remarkable either for size or speed.

The draught-horses were of superior quality, and much interest was manifested in their trial, which was admirably conducted.

The ploughing-match was sharply contested by a large number of horse-teams, and the work was well done—so well in fact that the most difficult task of the afternoon appeared to be that of the awarding committee. They must, however, have derived some comfort from the fact that they were allowed seven premiums for distribution.

The exhibition in the hall was of a high order of merit in the more substantial articles. The vegetables of all sorts were abundant and fine. The apples were in considerable quantity and of good quality, but concealed from view in the bottoms of deep glass cases. The absence of tables covered with the brilliant and beautiful fruits and flowers usually seen at our county fairs was very noticeable.

The fancy articles were however sufficiently numerous and excellent to make a charming display. While there were no less than sixteen silk patchwork bedspreads and quilts, there was also an unusually large proportion of more substantial and useful articles of domestic manufacture.

The exhibition of maple-sugar, honey and preserved and canned fruits was such as only old Berkshire can produce. But the butter was the crowning excellence of the whole. The quality was first-rate, and the quantity greater than ever was dreamed of at an Eastern fair. There were fifty-eight entries, and each consisted of a large jar or firkin full of the golden treasure.

Miss Sadie Smith, of Hancock, deserves special mention for an excellent herbarium of wild flowers, neatly mounted and correctly named. It would be well for our agricultural societies to offer premiums for collections in the various departments of natural history, in order to encourage the young to interest themselves in these most attractive objects of study. They are everywhere to be found, and remarkably suited in their infinite variety to awaken curiosity and develop habits of observation which will be of great service in after-life.

There is one most commendable custom in Berkshire which ought to be imitated in all parts of the State, and that is the active competition for the large and numerous premiums offered for farm-crops, farms, orchards, etc., etc. The spirit of emulation thus aroused cannot fail to promote most effectively the diffusion of knowledge on all subjects related to agricultural improvements, and to continue the interest, which is now too often limited to the annual fair, throughout the entire year.

The rhetorical exhibition on the third day brought out such competitors as Judge Colt, of Pittsfield, Hon. Richard Goodman, of Lenox, and Dr. Sabin, of Williamstown, the mention of whose names is evidence of a satisfactory show.

The thanks of your delegate are due to President Plunkett, Sheriff Root and Secretary Murray, for the most courteous and obliging treatment during his visit. He is happy in conclusion to state, that the financial condition of the Society is excellent, as appears from its published transactions, and that there is no reason for any anxiety in regard to its management or usefulness.

W. S. Clark.

HOOSAC VALLEY.

Having at a late day received from Mr. Root a request to take his place as delegate to attend the fair of this Society, I very reluctantly consented, not that I had any reluctance to being present as a citizen, but, after being present with the Board at Barre, and witnessing the advanced position of agricultural improvements in that region as compared with the very recent and feeble progress in the community embraced by the society which I have the honor to represent at the Board, I felt *inadequate* to do anything like justice to my position as Mr. Root's substitute. Another reason for being reluctant was, the near completion of the great tunnel. Having labored for that enterprise, and, in the exercise of strong faith in its final success, I had expected not to visit the Hoosac Valley again until it could be reached through the base of the mountain. Although near neighbors, as to distance, yet being separated by the Hoosac bluff, the social and commercial intercourse heretofore has been very slight. The final opening of that great avenue will bring our two societies into close proximity, and will no doubt tend to increase the efficiency of both.

But, having settled the question, I drove to North Adams on the morning of September 25, in a drizzling rain, arriving in season to witness the ingathering of the almost infinite variety of products and materials which was to constitute the show. It is a matter of astonishment to see the variety and amount of articles brought together at a fair by a community in which *all* the people are alive to make it a success. And such, apparently, was the case at North Adams. The Hoosac Valley Agricultural Society has shown itself well worthy the patronage of the Commonwealth. Located in a portion of the State of more than average fertility of soil, adapted to all varieties of production, embracing within its limits many thriving

manufacturing villages, we might expect a show of more than ordinary interest, and such, in fact, it was. The rain, no doubt, prevented many farmers from bringing out their stock of domestic animals, so that the exhibition in that department was comparatively meagre; enough, however, to show that the spirit of improvement in this branch of husbandry had been thoroughly aroused in the valley of the Hoosac. The various breeds—Shorthorns, Devons, Ayrshires, Jerseys and Natives—were all represented by specimens of which the exhibitors might properly indulge in a feeling of honest pride.

Oxen of various breeds were out in considerable numbers, and made a good show. The largest noticed by your delegate weighed 3,652 pounds, and there were others of nearly equal weight. Some nice two-year-old steers,—one pair two years old, owned by Gideon Kemp, of Florida, near the central shaft of the Hoosac Tunnel, weighing 2,050 pounds, and there were many other good animals.

The show of sheep was remarkably good; coarse, middle and fine wool were all represented by good specimens—Cotswold, Southdown, Leicester, Cheviots and Spanish Merino—showing that this branch of husbandry is appreciated by this Society, it being clearly proved by observation and experience of forty years, that for a mountainous region continuous sheep-husbandry pays the best of any branch, except dairying.

Dairy-cows were well represented by large numbers of excellent individuals and variety of breeds; also some good calves. The exhibition of herds was meagre; not what we had reason to expect, and probably but for the rain it would have been better.

The exhibition of poultry was on a grand scale. This branch seems to be growing in public favor all over the Commonwealth. Fifty-one entries, all the individuals being perfect of its kind, rendered this part of the show of unusual interest and attraction. All varieties known among modern amateurs were here represented, among which were Plymouth Rocks, White Leghorns, Seabrights, White Dorkings, Light Brahmas, Houdans, Dark Brahmas, Brown Leghorns, Red Game Bantams and Partridge Cochins, &c. Eight varieties of pigeons attracted attention, besides geese, turkeys and ducks. The exhibition reflected great credit on the officers and members and upon the community in which the Society is located.

We come now to the Society's hall. Here the display was munificent and imposing. The structure itself is one of the best for the purpose for which it was made of any in the State, and it was filled to overflowing by a great variety of articles, useful, curious and ornamental, which all the active minds in a community, alive to the thought of making a success of the opportunity, prompted the indi-

vidual to furnish, showing that the bounty of the State is not wasted upon a community unworthy of its patronage. The exhibition was, by *the local authorities*, pronounced "by far the best ever given at this hall." The details are far too numerous to allow even a catalogue in this report. Garden-vegetables in great abundance, variety and excellence.

The floral department in these shows is fast coming into public notice and favor. Here were flowers in great profusion and variety, indicating the advance of civilization and refinement in this community. Waxwork, beadwork, paintings and other works of art, household manufactures, photographs, harness-work, agricultural improvements, in great numbers and variety; grains, fruits, vegetables, canned fruits, in quantities sufficient to supply a small town; butter, cheese, maple-sugar, syrup, honey, etc. There were fifty-two entries of bread, both wheat and brown.

The exhibition of horses on the second day was equally creditable to the Society, and fully corroborates the other evidences of its vitality. Horses and colts in great numbers were entered, most of them having qualities of superior excellence, and well worthy of notice. Entries as follows:—

Matched-horses,	7	entries.
Single "	9	"
Trotting "	8	"
Stallions,	4	"
Breeding-mares,	8	"
Colts,	28	"

The third day was devoted to the trial of speed, but as your delegate did not remain, he can only report at second-hand, that everything connected with this day's exhibition was eminently successful and satisfactory. The address by F. P. Brown, Esq., of North Adams, was a very interesting and instructive one, the subject being, "Agriculture at Home and in the West." Excellent music by the Adams Band completed the entertainment, and the fourteenth gala-day of the Hoosac Valley Agricultural Society has won for it a high position among the sister societies of the Commonwealth.

ROGER H. LEAVITT.

HOUSATONIC.

The plan of the Housatonic Agricultural Society involves an exhibition and a social re-union of its members, lasting three days. How long this custom has existed I am not informed, but certainly the first field-day of its thirty-second annual exhibition, did not open with any deficiency of agricultural fervor apparent to a stranger. Some of our societies, with an annual two days' basking in the sun, feel that their mission is quite accomplished, and retire to sleep the rest of the year. I am, unhappily, unable to inform the Board, whether in the case of the Housatonic Society, the three days of effort bring exhaustion, and whether on the morning of the 24th of September, it has to be awakened with a louder thud than is becoming its dignity: I suspect, however, from several circumstances that occur to me, that the three days' work excites no untoward influence, but on the contrary, is so far invigorating as to lift the Society into an atmosphere where breathing is a pleasure, and not a task.

I esteemed it fortunate, as my sojourn with the Society could not extend beyond one day, that this was the first of the exhibition. This was devoted to the diversified interests of agriculture, and the hall and grounds were in their quiet possession.

The teaching of drawing in our public schools, and the encouragement extended to the study of form and arts of design, is likely to lead, in general, to a showing of better work at our fairs. Some small drawings engaged my attention that are worthy of mention. I am glad to observe that the Society encourages both household manufactures and household arts.

The long lines of firkins of butter—sixty entries—spoke the interest taken in the dairy. Among the firkins, was one filled with butter of a more golden hue than the others; but whether the Jersey cow, of which this was the product, affords more, or that of better flavor than some others, it will require some nice experiments to determine. Let these result as they may, the kindly, almost affectionate care the Jersey cow receives in general, and the much attention given to the making of the butter, *that it shall be as good as it can be*,—all this is exerting so wholesome an influence, that at any rate we ought not to wish her away without a blessing.

The interesting display of butter in the hall increased my desire to hasten to the cattle-pens without, to discover, if possible, whether the dairy interest was fitly supported by the breed or quality of the animals on exhibition. The grade animals, which constituted the larger number, indicated a various ancestry. There were less of

native, so called, than of foreign, blood in most of them. The predominance of the Shorthorn, or perhaps old Durham, did not prevent the occasional cropping-out of the Hereford, Devon and Ayrshire, and possibly Dutch, features. There was present various breed-blood alloyed in combination, that make it difficult to secure from the animals, progeny of fixed and desirable characteristics.

Nor was there evidence that the community, as such, had yet formed to themselves a model, towards which they were making the attempt to bring their animals to a correspondence. There were very excellent oxen; there were good meat animals; dairy animals also; but the latter were not so good to the eye as may be found in sections where for many years the dairy has been the one exclusive interest.

Let beef animals be perfected in the direction of beefy characteristics, and our milk animals in the milky line, assured that the two cannot exist in equal perfection in the same animal. It is possible exceptional circumstances may render a compromise animal more desirable.

A herd of Jerseys entered by Mr. I. M. Mackie, and a herd of Ayrshires entered by Mr. T. L. Foote, I was glad to see, as tending to encourage the breeding of cattle towards specific rather than general objects.

Of distinct breeds, the Society recognizes three—Shorthorn, Ayrshire and Jersey. In the thoroughbred, we have an animal that has been in a mould for from one to several hundred years; and all this time, man has been employing his utmost skill to develope specific, useful qualities, and to blot out such as are of a contrary nature. In using such, we are bringing to our service all these years of skilled pains-taking of many generations of men, and annexing our efforts on to theirs. The less of alloy in the animal, the more we partake of these advantages, and only those who are dissatisfied with the breeds already established, are justified in ignoring the results the past has brought down to us, and beginning below the height of success attained to found a new one.

The Housatonic Society is richer than many, and can extend generous welcome to contributors. Perhaps this generosity supports it in so doing. The first, second and third premium is as large as is customary. The feature to which I would call attention, is the offering, in many cases, of a fourth, fifth, sixth and so on, extending to the ninth—diminishing the sum of premium $1 each step from the higher to the next lower. The existence of a sixth or ninth takes nothing from the worth of the first, while it considerably supports the equanimity of the recipient of the former, since it partly or

wholly re-imburses the owner for the trouble and expenses incident to exhibition.

With the larger showing this system induces, the influence of the Society is enhanced, and extended to quarters where it is most needed. Those who receive the lowest premiums in a class are likely to be the most benefited by showing. Persons receiving the first prize are generally better informed in advance than others as to what constitutes a good article.

I abstain from remark upon the second and third days of the festival, further than to say, that I learn the weather was propitious, the attendance good, and the occasion was spoken of as a success.

JOSEPH N. STURTEVANT.

NORFOLK.

When appointed as delegate to the Norfolk Society, being aware that it was one of the oldest in the State, and contained within its limits some of the most distinguished and successful pomologists as well as agriculturists in the State or the world, we shrank from the duty, and would have preferred that one better qualified to represent the Board and do justice to the Society might have been selected. But when we entered their grounds, on one of the loveliest of our autumnal days,—although we were impressed with the extent of their preparations, their capacious grounds, their trotting-park, sufficiently ample to satisfy even the critical taste of a devotee of the speed and beauty of the horse,—the cordial greeting we received from the officers of the Society, particularly from the delegate to this Board, who anticipated our every want, entirely dispelled all personal considerations, and we thought only of the grand exhibition of the Norfolk Agricultural Society. Fearing we were occupying too much of the time of our good friend, Col. Stone, we suggested that we might be taking him from other duties. He replied, "It is my duty to devote all my time to you and the guests of the Society. I am appointed for that special purpose." We deem this an arrangement eminently fit to be made, and other societies would do well to follow the example.

The officers of a society at its annual fair are necessarily so occupied with their respective duties that they have little time to devote to invited guests.

It were a difficult task to describe the different departments of the exhibition, and discriminate in regard to the comparative excellence of each.

The exhibition of stock, comprising Jerseys, Ayrshires and Dutch, was particularly excellent, and the most extensive ever made by the Society.

The ladies' department was very fine, and though less extensive than we may have seen elsewhere, could not be excelled in quality or skill.

In that of fruit, it is sufficient to know, that the Society embraces within its domain the gardens of pomologists, whose names will be remembered wherever, and so long as, good fruits are appreciated.

The display of vegetables was magnificent.

In the poultry department there were twenty of the leading varieties exhibited, and we think no chanticleer, were he Brahma or Cochin or Spanish or Leghorn, etc., need have uttered one crow less on account of any deficiency in its particular class.

Of the part which the horse was called upon to play in the drama, we are reminded that the "Home Farm" is within the limits of the Society, and "Fearnaught" for the quality of the stock. The Morgan, Messenger, St. Lawrence, Morrill, Knox, Gray Eagle and Touchstone breeds were also exhibited.

But we shall weary your patience if we pursue this description farther, and will close by introducing far more reliable testimony. Hon. Marshall P. Wilder, who, in speaking of the comparative excellence of this compared with former exhibitions, was pleased to say: "I believe the audience will give me credit of having had some experience in this way, and I stand here to-day to say that I have never seen a better exhibition of the old Norfolk Agricultural Society than has graced its festival to-day."

Of its comparative merits with other exhibitions in the State—our honored secretary will pardon me for quoting his words—said he, "I have attended many exhibitions during the present season, and am happy to say that this is the crowning glory of them all."

Addresses were made by R. Morris Copeland, Esq., Hon. Marshall P. Wilder, President Clark and Hon. C. L. Flint, the exercises being interspersed with vocal and instrumental music.

Leaving the pavilion, all wended their way to the track where the closing exercises of the exhibition were to take place.

Tarrying there but a short time, we left for home, well pleased with what we had seen, and thankful for kind attentions received.

GEO. M. BAKER.

HINGHAM.

This Society held its exhibition on the 23d and 24th of September. The weather was rather unfavorable, and the attendance was somewhat diminished in consequence. No society has been more successfully managed or enjoyed greater prosperity than this. The grounds and buildings are admirably adapted to the uses of the Society, while all the arrangements connected with the exhibition seemed as nearly perfect as it is possible to have them.

The ploughing-match was, as usual, a success, and attracted much attention.

Though this Society is sensible enough not to encourage horse-racing, still it awards liberal premiums for good horses. There were fine matched-horses, stallions, breeding-mares, colts and family-horses on the grounds, which attracted much attention. It seems to us, that this Society has struck the happy medium in regard to horses, and we wish all other societies would follow its example. They do not ignore the horse, that all acknowledge is one of the noblest of animals, but they do not spend all their time, energy and money in this direction, to the neglect of all other branches of industry. It is said by some, that no such show can be a financial success without horse-races, but the experience of this Society most conclusively proves the falsity of this assertion.

Many fine working-oxen were shown; some of them were truly magnificent animals, equal to any we have ever seen. Conspicuous among the number were those of the worthy president, one pair of which weighed 4,200 pounds, and were perfect beauties.

There were on exhibition several fine fat cattle, which, if slaughtered, would furnish beef good enough for an epicure. There were several fine Jersey bulls, with Ayrshires, Durhams and Devons, there being as many as eight that took prizes.

Of calves and heifers there was a large show, including Jerseys, Durhams, Devons, Ayrshires and grades. There were many prizes and gratuities awarded for this stock. Many of them were good animals and would rank well at any cattle-show, large or small.

One of the specialties of a Hingham show is that of swine, of which there were forty-six in the pens. We have never seen so many *good* pigs and hogs at any exhibition of any county society.

Many sheep and lambs were shown, of the Cotswold, Southdown and Leicester breeds. In no part of the State have we seen finer animals of these breeds than were here shown. There were one hundred and twenty of these animals on exhibition. How it is pos-

sible for our Hingham friends to raise sheep, when dogs are so plenty, we cannot understand.

Fowls were shown in large numbers and of excellent quality. There were geese, ducks and pigeons, in addition to hens and roosters of every name, size and color, showing that this department has certainly not been neglected. There were some forty premiums and gratuities awarded for these birds.

In the hall the show was fine. The vegetables were generally of excellent quality, an improvement on what we have ever seen here before. A great improvement has taken place in the raising of vegetables within the past ten or fifteen years, all over the State, and we are very glad to see it. Fresh vegetables are one of the blessings to be enjoyed in the country, and should be found upon the table of every person. The town of Arlington takes the lead in growing fine vegetables for Boston market, and doubtless will continue to do so for many years to come, but the members of this Society have certainly shown that they are able to raise vegetables good enough for market or home use.

There were also grains and garden-seeds shown for premium.

The children's department, a peculiar feature here, attracted much attention, and many of the contributions received premiums or gratuities.

The show of apples surprised us very much, for the year was an off one for this fruit. There were no less than two hundred and thirty-three dishes, of sixty varieties, by forty-three contributors. The fruit was smooth, handsome and good.

The pears were good, but not superior; some contributors showing thirty-five, or more, varieties.

There were grapes, both foreign and native, with peaches, quinces, cranberries and other fruits, all making up a very good horticultural show.

There was a profusion of flowers, with floral designs, that spoke well for the taste of the contributors.

The butter could not be excelled in appearance, but of the quality we were not permitted to know, as it was "hands off" to all but the judges.

After the butter came the cheese. After the cheese the bread, both white and brown, that looked good enough to eat with or without the butter and cheese beside it.

Six of the prizes for bread were awarded to unmarried ladies, all of whom have shown themselves fit to become the wives of sensible men who want good helpmeets.

There were many pickles, preserves and jellies, good enough for anybody, prepared by the fair hands of wives and daughters.

Of manufactures there was a good display, representing the industries of the region round about, while of fancy and useful articles, contributed by the ladies, there seemed to be no end.

In addition to the attractions we have noted, there was a spading-match, a trial of fire-engines, as well as good music by the Germania and other bands.

On the second day there was a dinner in the upper hall, and it was just such a good dinner as one always gets at Hingham, and just such a dinner as one *does not* always get at other cattle-shows.

After the dinner, excellent speeches were made by the president of the Society, Governor Washburn, Judge Russell and others.

We shall ever regard our visit to this Society as among the most pleasant of our official duties.

In conclusion, we desire to say, that we think the Hingham Society make a good use of the state bounty, and are fully entitled to receive it.

James F. C. Hyde.

BRISTOL COUNTY.

We had the pleasure, as delegate of this Board, of attending the annual exhibition of this Society, held at Taunton, September 30th, and October 1st and 2d, 1873.

The Society's grounds, comprising seventy acres, inclosed by a substantial fence, contain a fine hall, stables, sheds and pens, very suitable for the convenience of exhibitors and the welfare of the stock. Systematic arrangement of neat-stock was not observed, rendering examination more difficult.

The track,—perhaps it may now be called the safety-valve of the Society,—is excellent, and the judges' stand, as an architectural structure, cannot well be surpassed. In fact, the grounds and buildings seem to be replete with all the conveniences necessary for a successful fair.

The Society has long been favored with the persevering efforts of energetic officers. Upon entering the grounds, we were struck with the beautiful grove of trees, evidently planted by the hand of nature, but well kept and made attractive by the good taste of those having it in charge, and we were led to the thought that here was a Society, by its example, contributing to the welfare of both man and beast; here youth can enjoy their sports, and age repose beneath the overshadowing influences of trees which contribute cheap comforts alike to all, and draw them into irresistible companionship with nature. Groves of trees on the grounds of societies, by their influence, will

have a tendency to stimulate the planting of ornamental and forest trees, which is now comparatively neglected.

The Society's hall, whose imposing appearance next meets the eye, is of a most substantial character, apparently adequate for the large exhibitions, which seem to combine the products of the farm and the garden, as well as the products of all branches of the productive industry of the county. It would be impossible to particularize the contributions that filled this immense building.

The contributions in the vegetable department embraced a great variety. The better class of garden-vegetables and roots grown for feeding stock, were of especial merit. Cereals, although shown in variety, did not appear to be a leading interest.

In the fruit department, pears were most prominent; many plates were especially good, and of sorts at once recognized as the best of their season.

The unusual short crop of apples in this section prevented large contributions, but those on exhibition were good varieties. Good fruit is positive proof of good soil and cultivation.

The display of grapes grown under glass and in open culture, was of a high degree of excellence, comprising those best adapted to this climate. Perhaps no fruit is more easily grown, though it requires skilful care and judicious thinning to bring the quality up to the highest standard. The good cultivator of the grape feels a tenderness for his vines and knows they will not tolerate neglect.

The displays of peaches and plums were small; disease and insects render these fruits uncertain and unprofitable.

Flowers and ornamental plants were unusually fine, and their arrangement would have been creditable to any horticultural exhibition. Of the manufactured articles prominent, were the lighter and ornamental parts of the locomotive, contributed by the president of the Society, denoting skill in workmanship and elegance of finish.

The long tables of plated ware were of exquisite designs and finish, and their just merits could only be appreciated by the mechanical mind.

The apiary was well represented, and the practical workings of the bees shown in ingeniously constructed hives; and a large and fine display of honey (the honest article) made, in glass covers; the exhibition being liberally encouraged by the Society.

The large entries of bread, butter, preserves and articles of household manufacture were very creditable to the ladies of the Society; in short, the hall exhibition in all its departments was the finest that your delegate has ever beheld.

The cattle comprised a large number of both pure breeds and grades; the larger number being grades, which their owners seemed to think adapted to their respective wants, as they depend upon the

tender-hearted butchers and milkmen for returns and profits. We noticed among them many fine animals for beef and the dairy.

The pure breeds, Durham, Ayrshires and Jerseys, were also shown in considerable numbers, and they were good specimens of their respective breeds. They received their due share of the attention and criticism of the people, and the owners of the several breeds seemed to believe thoroughly in the ends they had in view. We believe that cattle-husbandry in this county is progressing in the right direction; that breeding pure-bred stock is receiving intelligent and commendable attention; and the gentlemen whose generous labors have contributed so largely to the exhibition are benefactors to the present and rising generations.

Poultry evidently is receiving intelligent breeding and care in this county, and the display was unusually fine; perhaps there was no department in the exhibition more complete. The indiscriminate collections of poultry usually seen at fairs have had their day, at least at Bristol, and are now giving place to those of pure breeds, the larger part of the fowls and chickens shown being bred to standard points. The matching of pairs or trios of fowls, was in most of the pens good. By a careful examination of this department, we were led to the conclusion that the influence of distinguished breeders in the vicinity has given a healthy and refining influence to the poultry interests hereabout. This department was constantly crowded with eager visitors, especially the ladies, many of whom, we have no doubt, were either owners or joint partners of some of the pens exhibited.

Sheep were not shown in large numbers, and were mostly bred for mutton; there were, however, some choice lots.

Swine were shown of good breeds, and were of all stages of growth, from the well-fattened mature hogs to litters of pigs a few weeks old, all indicating good care.

The dinner was excellent and was enjoyed by large numbers, the hall being well filled; after which the company were highly entertained by an eloquent address by His Excellency the governor of the State, whose shoulder is at the wheel of agriculture. President Clark, of the Agricultural College, also delivered an address.

That the Bristol County Society is making efficient and honest efforts to promote agriculture and its kindred interests, there is every reason to believe, and we were gratified to notice that they were duly appreciated by the interested people who visited the fair by thousands, and contributed so largely to the success of the occasion.

In closing, we desire to express our thanks to the officers of the Society, and to the delegate of this Board, for their unremitting kindness and attention during our stay.

O. B. Hadwen.

BRISTOL CENTRAL.

The Bristol Central Agricultural Society held its annual show at Myrick's, September 10th, 11th and 12th, 1873. Circumstances beyond the control of myself prevented me from attending the exhibition, except the last day. I regretted very much that I was unable to have been present on the 11th, the second day of the show, as that was more particularly designed for the exhibition of stock, ploughing-match, etc. But, upon my arrival upon the grounds on the morning of the last day, I saw evidences, at once, of a successful exhibition.

The only method I had of learning what stock was on exhibition was from the entries which appeared on the secretary's books, and such information as I gathered from those who witnessed the exhibition.

I found that the exhibition of stock was unusually fine. A large number of entries were made in the different classes, and the animals were in many respects superior.

The sheep were particularly noticeable, and numbered more than fifty head.

There were sixty-six entries of swine of various breeds, and each contributor was eager to point out the superiority of that breed which his own animal represented, and by a comparison of the different animals representing the different breeds. Standing side by side, the attentive observer could decide for himself which of the several breeds was the most profitable to raise.

The exhibition of poultry was unusually large. There were eighty entries in this class, and very many fine specimens of the various kinds known to the poultry-breeders.

The exhibition of farming-produce, fruit, fancy-work, domestic and other manufactures in the hall was very creditable to the Society, and evinced great interest by the contributors.

The last day of the show was devoted almost exclusively to the exhibition of that most noble of all animals, the horse, and I do not wonder that most of our agricultural societies have seen fit to devote one day of their exhibition to this object. I believe it is a part, and an essential part, of the agricultural interests of the country, and while very many of our agriculturists object to giving so prominent a place to the horse as has sometimes been assigned, I confess my great fear is, that *too little* prominence will be given it. Although I do not forget that dairy-stock and cattle demand, and should receive, the close attention of all agriculturists, yet I do also remember, that for the success which agriculture to-day presents in this country, a large share of the credit belongs to the aid

received from the horse. While horse-racing at some of the fairs may be carried to excess, I should deeply regret any action of this Board which should exclude premiums from being offered for trials of speed in horses.

The show of working-horses was very fine indeed, as also of carriage-horses. I noticed some splendid stallions and colts; there being separate classes for colts for trotting purposes and colts for all-work, which seemed a very proper division.

Your delegate is very happy to say, that he found connected with this Society, elements for future growth and prosperity. In fact, it almost seems as though it must continue a successful Society.

As I walked about over its spacious and commodious grounds, and beheld the large contributions in almost all the several classes, the large concourse of people and the earnest, active, energetic spirit which they manifested, I naturally inquired of myself, Why is this? What should make so much difference between the appearance here and that of some other societies which I visit? But before I left the grounds I had satisfactorily solved the problem. I found the officers and managers of the Society were *live men* and *women.* With an eye to look and an ear to hear what seemed to be for the best interests of the Society, they had toiled and worked together, unitedly and harmoniously. And here I desire to say, that the agricultural societies of the Commonwealth can insure their success in no better way, than by keeping close vigilance over the election of their officers, and seeing to it that none but energetic, active, thorough-going men are placed in charge. The rotation adopted by some societies, in order that all may share in the honors, is, in my judgment, detrimental to the interests of the society. The most successful societies are those who have carefully selected their officers, and, when found competent, have retained them.

I cannot conclude this report without extending my heartfelt thanks to the officers of this Society for the very courteous and obliging aid they rendered me. And especially am I under very great obligation to our worthy associate, Hon. John A. Hawes, president of the Society, and to his estimable lady, for their kind hospitality to me, at their beautiful home in Fairhaven. Among the many pleasant associations connected with my membership on this Board, as I retire, not the least among the number will be pleasant memory of my visit to the Bristol Central Society.

May the inspiration and zeal manifested by its officers be communicated to and retained by all its members, and the future of this Society will be a bright example, worthy of imitation.

F. F. Fay.

PLYMOUTH.

The annual exhibition of the Plymouth County Society was held at Bridgewater, on the 17th, 18th and 19th of September.

The first two days were very pleasant. I was there early on the morning of the first day, and received a hearty welcome from the president, Charles G. Davis, who immediately accompanied me to the grounds of the ploughing-match. The surface of the different lots was rather uneven, and the sod rather tender, but the result showed that most of them did their work well. I think the ploughing-match should not be omitted at any of our fairs.

Next came the trial of working-oxen. There was a good show of working-oxen, some very nice pairs, well broken, and with intelligent and humane drivers; no loud talking or whipping.

Next came the trial of walking-oxen; six entries were made, each pair to walk half a mile. The quickest time made, was by animals owned by N. M. Sampson; time, six minutes and a half. I wish this feature might be taken up by other societies, for I think they would find it interesting and profitable.

The display of animals in the pens was large and varied. There were 366 head of cattle, swine, sheep and horses, not including cattle entered for labor. Superintendent Leonard, of the state workhouse at Bridgewater, made a splendid show of Jerseys and Ayrshires; also fine herds were shown by Samuel W. Bates, of Bridgewater, and Harris Staples, of Lakeville. The latter exhibited a Jersey heifer, which produced a calf at the early age of fourteen months.

I think I have never seen a better show of milch-cows than was exhibited at this fair; there were fifty-seven entries. The Jerseys and Ayrshires seemed to be the leading breeds of this county, though the former were more numerous than the latter.

The show of fat cattle was small, and not very creditable to the Society.

Of sheep, the Hayward Brothers, of Bridgewater, presented as fine a lot of Cotswolds as I have ever seen in the State; also some fine Southdowns were shown by George Bump, of Middleborough. The Berkshires seemed to take the lead in swine; a fine display was made by Hayward Brothers.

A fine place has been fitted up for the show of poultry, which is highly commendable to the Society, and well worthy of imitation by other societies. There were seventy-five coops in all.

The poorest show in any department was in breeding-mares, colts and stallions; but few entries were made, and very few worthy of note.

There were a number of pairs of handsome matched-horses, also of family-horses; on the whole the show was commendable. The display in the hall was very good, excepting in fruit, of which there has been a meagre show through the State, unless it be with the Franklin County fair, at Greenfield, where there was the best display ever seen in that hall. The show of vegetables was not large, but very good.

The grounds of the Society are better adapted to the purposes for which they are devoted, than any I have seen in the State. They contain more than sixty acres, for the most part of an undulating surface, with plenty of shade-trees, good running water; the hall overlooks the whole. Last, but not least, the officers understand how to get up a good show, to make it interesting and profitable. One thing I learned, the people were generally interested in their annual fair, and but very little money is paid for bringing contributions to the fair. I came away, feeling sure that the Society is doing a good work.

ELNATHAN GRAVES.

MARSHFIELD.

The seventh annual exhibition of the Marshfield Agricultural and Horticultural Society, was held at the Society's grounds, Oct. 1st, 2d and 3d.

The weather that makes or mars our fairs to a greater or less extent, was during the three days of the exhibition delightfully pleasant. Nature, seemingly in sympathy and unison with the festive occasion, had donned one of her brightest and gayest autumnal robes in honor of the farmers' holiday. People with teams and by rail, came pouring in, in almost unaccountable numbers, until during the second day, when, by estimation, nearly eight thousand were present; and some of the originators of the farmers' club, from which the Society was cradled, expressed themselves as "perfectly satisfied." It was even more than a realization of their most visionary expectations.

This Society is laboring very systematically and successfully in extending its influence, and its prospects seem more than ever flattering. It has a fine locality, an attractive and commodious hall and ample grounds, which are annually being improved; and with such continued zeal and good management as is shown by its present Board of officers, we think will soon become leviathan in strength, stepping into the front ranks among its sister societies, as it has already won an enviable position in many respects among the agriculturists of the State.

The show of neat-stock was not large. Of pure blood, there were the Jerseys, Ayrshires and Devons; but for the most part were those usually found upon common farms. Three pens of stock, said to be "not his best," shown by James F. Leach, of Bridgewater, made a very good appearance. "Daisy," an Ayrshire cow, and two heifers, were beautiful creatures. Several yoke of fat oxen, weighing between three and four thousand pounds, also a nice pair of working-oxen from Duxbury, attracted attention. A number of pretty calves, and among them a pair of twin steers, six months old, alike in form, marks and features.

A team of ninety-three yoke of working-oxen were hitched to a large farm-wagon, a premium pair on the tongue being decorated with blue streamers, and the wagon filled with jolly lads, headed by the Weymouth band, in a large open carriage, and all under the direction of chief-marshal Oakman, passed three times around the track, making a very imposing appearance.

Of horses and colts there was a very good show, comprising draught, walking, family, driving and matched horses, breeding-mares and colts. The stallion "Red Hawk," by J. Houghton, of Milton, made a fine appearance upon the track. Among the colts, "La Victorine," a splendid creature, owned by J. Weston, of Duxbury. No premiums were paid for trials of speed. Of sheep and swine, only a small number of entries each.

The exhibition of poultry was large and very fine, containing some two hundred and seventy-five specimens, including light and dark Brahmas, Partridge, buff and black Cochins, Plymouth Rocks, white and black Leghorns, Golden-spangled Polands, Guinea-fowl and a cage of little silver Seabrights. Of turkeys, there were the bronze and white Honduras; and of geese and ducks, some very fine; the Hong Kong, Bremen and wild geese; half wild ducks and others, taken altogether, making a very interesting exhibition for a county show.

O. E. Moore, agent, exhibited a stump-puller and rock-lifter, using a small model for demonstration. Applying a slight pressure to the end of a wooden lever, about half an inch in thickness, and ten inches in length, the agent lifted two men whose united weight was four hundred and eighty pounds. It was stated, that the large machine with the effort of one man would raise fifteen thousand pounds.

If I was in the habit of going into ecstacies and becoming poetical, I should do so in giving a description of the elaborately wrought and tasteful arrangement of articles in the hall. Beauty *animate* and inaminate, greeted one on every hand. In the atmosphere was distilled "the odor of a thousand flowers," and in the exquisite taste

of their arrangement was displayed the artists' skill in the blending of colors.

The most attractive floral design was contributed by Mr. Alfred Phillips, of Marshfield. He also contributed a variety of bouquets. Pot and foliage plants, several beautifully arranged bouquets and tasteful designs and baskets were exhibited by the ladies.

Bread, butter and cheese looked temptingly appetizing, as I passed from that which delighted the eye to the substantials of life. There were but few entries of bread, fifteen pots of butter, and about a dozen specimens of cheese, also of pickles, preserves, jellies, etc.; an unstinted array, reflecting credit upon the managers of household affairs in providing so bountifully these toothsome articles for the table. Nestled in close proximity were some of the largest and handsomest cranberries that I have ever seen.

There was a large and choice variety of apples, pears, plums, peaches and grapes. Of pears seventy-two varieties, some of them remarkably fine. Of grapes, the Concord is most extensively grown. Some of the finer varieties raised under glass were on exhibition, among them were the Black Hamburg and Delaware. Then came the fancy-work, an almost endless variety, indicative of the taste and skill of the ladies. One novelty among the vast array, was a bedquilt made by the oldest ladies of Hanover, whose ages and names were respectively inscribed on its blocks, the sum of their united ages being 3,701. A pair of mittens and stockings, made from dog's hair, illustrated the fact, that almost everything may be converted into use.

The children's department, as managed by this Society, is quite interesting. Number of contributors, eighty-four; articles, one hundred and fourteen. Premiums were not large, but to the little folks sufficient to encourage their doing whatever they did in the best manner.

The chairman of committee on rural sports, contributed a case of old-fashioned articles, representing "What he knew about the fashions of grandsires day"; the whole largely humorous. Under the management of this "Man of Fun," was also a foot-race, sack-race, wheelbarrow-race, calf-race and pig-race: the two last did not interest me favorably, as it seemed to border on "Cruelty to Animals."

The show of vegetables was large, and included many kinds, and seemingly the very best specimens of the kind. Corn, potatoes, onions, tomatoes, mammoth cabbages and squashes, some of the last weighing forty, sixty, and one hundred pounds. Indeed, the vegetables changed my mind about the products of Marshfield. Before going there I could not rid my mind of the idea of salt grass; but

when I saw the vegetables, I knew other things than marsh hay were grown there; and it seems to me the way is being opened for great improvements in the marshes of this section; and I believe the time is not distant when much better hay, and more stock and vegetables will be raised there.

A goodly number of teams joined in the ploughing, and the work generally was done well. A part of the ground was filled with strong roots, making it hard work for the teams. James F. Leach's team, of Bridgewater, who took the first prize here and at the New England fair, did the work remarkably well.

The dinner, the second day, was a most excellent repast, with five hundred ladies and gentlemen seated at the tables. After this, followed the appropriate address of the president, George M. Baker, and at the conclusion he turned to Governor Washburn, who was seated on the platform, and gave a beautiful sentiment to the "Commonwealth of Massachusetts," which was responded to by the band, "Hail to the Chief"; when His Excellency the governor came forward and gave an interesting address, that was listened to attentively, and enthusiastically applauded at its close. The president then gave another sentiment, "To the Agricultural College"; to which Col. Clark responded, in his usual energetic way, and was often interrupted by hearty cheers.

The company then adjourned to the open air, and remarks were made by Col. Stone, of Dedham, and a poem read by E. P. Dyer, of Shrewsbury. In the evening there was a concert by the band. Among the important exercises of the last day, was an address to the farmers, by Hon. Charles G. Davis, of Plymouth.

I cannot close without expressing my heartfelt gratitude to the officers of this Society, especially to our esteemed friend, George M. Baker and his family, for their kindness in providing for my wants during the exhibition. Also to Dr. S. Henry, who took me into his carriage, and carried me to the "Webster place," the "Beach," the "Dyke," "Meadows," etc.

J. McElwain.

NANTUCKET.

In reporting the 18th cattle-show and fair of the Nantucket Agricultural Society, held on the 24th and 25th of September, I may quote its efficient secretary, who says, "As an exhibition it exceeded the expectations of all. In a business point of view it was a financial success." The Society, he adds, has freed itself from debt and accumulated a small fund.

The isolated position and agricultural disadvantages of Nantucket have not deterred or discouraged the officers and members of the Society in the attempt to further the productive interests of their sandy territory.

The exhibition this year began with a rainstorm which, however undesirable as an adjunct of a cattle-show, was most welcome, since it had been preceded by a drought of great severity. The entire rainfall from May 8th to September was only 1.84 inches, and the consequent injury to crops can be imagined. The early vegetables were largely destroyed, and hay and pasturage a general failure. Notwithstanding this great drawback, the exhibition was certainly a most creditable one.

The stock shown was less in number than in previous years, the drought having made it necessary for a large porportion of the cattle upon the island to be sold, no less than fifteen to twenty per cent. having been disposed of; but, as the wise course was followed of keeping the best, the loss is in quantity and not quality. About 150 head were shown, a good part thoroughbred, including some fair Ayrshire and Jersey bulls.

A display of horses and colts was also made, with one two-year-old weighing 1,030, which is certainly strong testimony for the possibilities of nutrition upon Nantucket.

Mr. G. C. Gardner entered a fine flock of Southdown sheep; and swine, poultry, etc., were not lacking.

The exhibition in the Athenæum Hall was quite an interesting one, and arranged with much care and taste, the walls being adorned with elaborate mottoes. The show of butter was good, though not large. Fruit appeared in considerable variety; quinces and melons were especially fine; also the hot-house grapes.

In art, portraits and sea-coast views were creditably done, in oils and crayons; several sketches, of varying degrees of merit, by young artists; and some capital wood-carving by J. A. Folger. Some foreign curiosities were shown; and amid the ladies' work a very large piece of embroidery, a scene on canvass, some five feet square, the work of industrious fingers while on a whaling voyage.

Nantucket (town and county are identical) has declined in population from 10,000 to 4,000; but at present its attraction as a summer resort seems likely to balance the decay of the whaling interests, and send the fortunes of the people up again. Hotels and cottages are going up, a horse-railroad is talked of, and sanguine views are cherished by property-owners. Some quaint flavor of old-time life still lingers, and long may the unique customs which now exist there be perpetuated. We have too much of flat uniformity in American life, and it is quite refreshing to find a place where the town-crier

still flourishes. The pleasant virtue of hospitality certainly thrives in Nantucket, and to Andrew M. Myrick, Esq., as an exemplification of it, our hearty thanks are due.

HENRY S. GOODALE.

BARNSTABLE.

The Barnstable County Agricultural Fair was held at Barnstable, on Tuesday and Wednesday, the 7th and 8th of October, 1873. Charles S. Sargent, Esq., of Brookline, was delegated by the state board to attend and report upon the proceedings of this Society, but his absence in Europe prevented his attendance, and I have, by request of that gentleman and a vote of this Board, made a report, necessarily a brief one, having preserved no notes to aid me.

The weather, on both days of the fair, was cold and uncomfortable, with a north-east wind blowing almost a gale. The attendance was consequently much smaller than it would otherwise have been, although it did not prevent a pretty good attendance before the close of the second day.

In some respects the show was one of the best ever held by the Society. The display in the hall never was better. In the department of fruit more than one hundred premiums were awarded, and the varieties were large and very superior. The exhibition of fancy articles, domestic and household manufactures, was unusually large and attractive, and creditable to the ladies of the county.

Nearly every town, within twenty miles, had vegetables on exhibition, in great variety and of a superior quality. The butter and cheese was not large in quantity, but was of excellent quality.

The cattle-pens were well filled. Some of the Alderneys exhibited by the "Bacon Farm," L. L. Goodspeed, Esq., and S. B. Phinney, would compare favorably with those on exhibition at the New England fair, a few weeks previous.

The show of horses and colts was equal to former years.

It is enough to say that the fair was a success, and, except for the unfavorable weather, would have exceeded any previous year.

The dinner of the Society, in the upper hall, on the second day, was well attended. Gen. Benjamin F. Butler delivered the address. He was met at the depot by many of the members of the Society and the Rescue Hook and Ladder Company, and escorted by the Cornet Band of that place to the fair-ground. The exercises at the dinner were interesting. After prayer by Rev. Mr. Pope, Gen. Butler delivered his address upon the subject of "Debt, National and Private." This occupied nearly an hour, and was listened to

with marked attention. After the singing of a "Farmer's Song," and music by the band, interesting speeches were made by Gen. Butler, Hon. F. H. Sawyer, assistant secretary of the treasury, Hon. J. B. D. Cogswell, Dr. T. N. Stone and others.

This Society exercises an important influence in this section of the State. It serves to increase a knowledge of agriculture among a class of people whose pursuits, for the most part, are maritime, and it serves also to awaken and stimulate a laudable ambition among the sons and daughters of Cape Cod—as well as its practical farmers—in the culture and management of their farms.

The Society has active workers, men zealous in the cause of agriculture, and its ability to do good is annually increasing. Nowhere among the local societies is the award of the State doing more good in aiding and encouraging agriculture than in Barnstable County.

S. B. PHINNEY.

MARTHA'S VINEYARD.

Your delegate to this Society left home on Saturday, in order to be on hand in time for the show on Tuesday, October 5. Tuesday came, and brought with it a drizzling rainstorm, which continued through the day, notwithstanding which large numbers of men, women and children assembled at the fair-grounds and hall, bringing in numbers of cattle of all ages, sheep, swine and poultry.

The exhibition inside the hall was a decided success, and the room was filled to repletion with everything calculated to show forth the skill, the industry, the activity, economy and enterprise of the islanders. It seemed as if each one vied with every other one to make the exhibition a success, and it *was* a success; the people said it exceeded anything of the kind ever seen on the island.

The islanders are beginning to awaken to the situation. They have an inheritance which only needs development to come up alongside the other portions of the Commonwealth.

Cultivation of fruits will soon become their specialty. From the specimens seen in the hall, it is evident that the soil and climate are peculiarly fitted to the production of apples, pears, quinces, peaches, grapes, cranberries, raspberries and strawberries, in fine, all the fruits of this latitude, and, as a market is growing up in the island, your delegate advised more attention to this branch of productive industry. The soil of the island is of very light character, yet a very small amount of fertilization is required to produce these fruits. Should the attention of the people be turned in this direction, there

can be no doubt of the steady increase of wealth flowing therefrom, thus remunerating the Commonwealth for her generous bounty. The show of garden-vegetables was extremely good, both in variety, quality and quantity. But the greatest show of all was in fruit,—apples, pears, grapes and quinces, thus indicating the fact that the greatest capability of the island is in this direction, and confirming the opinion that the "Vineyard" received its name from its natural adaptation to the growth of these fruits.

A good show of neat-stock, mostly Ayrshire, oxen, cows, three-year-olds, two-year-olds, yearlings and calves, mostly grades. The island seems not particularly adapted to this branch of husbandry, and the people seem desirous of making some change.

Sheep seem to do very well, and there was a good show of several varieties, all excellent of their kind.

Here, as well as in many other places, poultry seems to be coming into favor. The display was very satisfactory. The Society were liberal in their offers of premiums, and the community are evidently catching the spirit of the times in this matter. The show consisted of hens of various breeds, and varieties of turkeys, geese and ducks.

The show of horses was meagre. It is evident that, whatever branches of industry had engaged the attention of the islanders, improving the horse had not been a specialty. A few good family-horses were shown, two or three good breeding-mares and a number of promising colts. The whole show of horses, however, left an impression that a mission to the island by Rev. W. H. H. Murray might be turned to good account.

The ploughing-match was a small affair: three teams only engaged. The exercise added a little to the day's enjoyment, and afforded an opportunity to dispose of a small amount of the Society's funds,—beyond that, it was difficult to perceive any very decided advantage growing out of this feature of the exhibition.

Flowers.—This department was fully sustained. The island is peculiarly happy in her floral kingdom; here were displayed in most tasteful form, arranged by the fair hands of the Vineyard's daughters, every variety of the most beautiful flowers of the season, showing that, while they may be behind the times in some departments of modern progress, they are fully up in the floral.

In conclusion, be it said, perfect order prevailed throughout. We had very excellent music by the Mansfield Band. Many thanks are due to the people of the Vineyard for their kind attention and unbounded hospitality, rendering the visit of your delegate one of unmingled pleasure, for which he will ever retain sentiments of grateful remembrance.

ROGER H. LEAVITT.

FINANCIAL RETURNS

OF THE

AGRICULTURAL SOCIETIES,

For 1873.

8

FINANCES OF THE SOCIETIES.

SOCIETIES.	Amount received from the Commonwealth.	Income from permanent fund.	New members & donations.	All other sources.	Receipts for the year.	Prem's offered.	Prem's and gratuities paid.	Current expens's for the year—not including premiums and gratuities.	Disbursem'ts for the year.	Indebtedness.	Value of real estate.	Value of personal property.	Permanent fund.
Massachusetts, . .	-	$5,818 94	$7,279 73	-	$13,098 67	-	$4,029 71	$805 72	$4,835 43	-	-	$70,000 00	$70,000 00
Essex, . . .	$600 00	1,487 23	533 00	$1,741 03	4,361 26	$2,460 00	1,020 00	2,268 89	3,288 89	-	$8,000 00	17,500 00	25,500 00
Middlesex, . . .	600 00	-	297 00	2,660 64	3,550 64	2,408 00	927 74	2,838 30	3,764 04	$14,000 00	25,000 00	1,000 00	12,000 00
Middlesex North, .	600 00	-	53 00	1,995 75	2,648 75	1,337 00	686 50	1,308 04	3,256 81	-	25,000 00	826 00	25,826 00
Middlesex South, .	600 00	-	105 00	3,759 93	4,464 93	1,885 75	1,143 70	2,111 89	4,623 19	11,400 00	18,000 00	-	6,600 00
Worcester, . .	600 00	100 00	-	5,726 25	6,426 25	3,062 75	2,614 58	4,395 46	7,010 04	31,000 00	125,000 00	1,000 00	95,000 00
Worcester West, .	600 00	88 00	103 00	5,969 93	6,838 33	1,963 25	1,506 95	6,554 59	7,061 54	3,159 91	13,700 00	584 00	10,540 09
Worcester North, .	500 00	-	871 38	2,467 85	3,339 23	1,749 75	1,197 75	2,783 06	3,980 81	10,700 00	16,000 00	50 00	6,000 00
Worcester N. West, .	600 00	-	358 50	3,329 94	4,288 44	1,726 00	1,284 59	2,880 18	4,164 77	10,522 47	16,000 00	1,700 00	7,177 53
Worcester South, .	600 00	1,936 63	98 00	1,782 83	4,417 40	1,538 50	1,250 25	2,676 79	3,926 54	6,000 00	12,800 00	1,500 00	8,431 35
Worcester S. East, .	600 00	400 00	192 30	50 00	3,039 75	1,336 00	571 55	369 02	2,979 59	9,500 00	14,000 00	1,000 00	5,500 00
Hampshire, Franklin & Hampden, . .	600 00	-	101 00	10,224 49	10,925 49	1,424 75	1,065 50	3,434 84	10,925 40	7,706 24	14,000 00	500 00	7,200 00
Hampshire, . .	600 00	-	50 00	1,384 19	2,034 19	917 50	667 83	939 29	1,607 12	1,400 00	6,000 00	300 00	4,900 00
Highland, . . .	600 00	88 00	26 00	460 68	1,174 68	743 05	624 55	452 63	1,077 18	-	3,000 00	1,300 00	4,300 00
Hampden, . . .	600 00	-	80 00	3,001 05	3,681 05	1,535 00	621 87	2,980 35	3,602 22	24,000 00	90,000 00	50 00	64,000 00
Hampden East, . .	600 00	-	296 20	442 79	1,338 99	1,301 50	808 68	623 83	1,432 51	-	5,000 00	275 40	5,275 40
Union, . . .	600 00	-	149 58	505 19	1,254 77	941 25	581 25	578 51	1,159 76	1,600 00	4,600 00	575 00	3,575 00

Franklin, . . .	$600 00	$120 00	$232 50	$1,148 09	$2,100 59	$1,463 75	$1,129 75	$1,089 03	$2,218 78	-	$7,000 00	$1,400 00	$8,400 00
Deerfield Valley, .	600 00	-	372 63	2,794 91	3,867 54	857 50	610 28	1,113 17	3,649 92	$3,420 44	5,000 00	15 00	1,594 56
Berkshire, . . .	600 00	681 59	103 00	3,065 86	4,450 45	3,479 00	2,782 00	1,527 08	4,309 08	-	10,000 00	1,000 00	10,000 00
Hoosac Valley, . .	600 00	100 00	571 00	4,608 29	5,879 29	1,776 50	1,402 75	2,047 42	5,942 97	5,831 32	11,300 00	865 00	6,000 00
Housatonic, . .	600 00	-	91 00	4,483 48	5,174 48	3,023 00	2,241 50	2,937 48	4,652 14	-	3,500 00	150 00	15,000 00
Norfolk, . . .	600 00	-	123 00	3,470 38	4,193 38	2,291 00	1,603 50	2,572 57	4,176 07	27,700 00	35,000 00	300 00	7,600 00
Hingham, . . .	600 00	-	406 00	3,174 20	4,080 20	1,917 75	1,241 45	3,025 72	4,072 07	5,000 00	34,600 00	4,600 00	29,600 00
Bristol, . . .	600 00	-	474 00	9,698 44	10,772 44	3,947 25	3,523 50	4,143 50	8,632 50	10,000 00	64,700 00	450 00	50,000 00
Bristol Central, . .	600 00	-	90 00	3,114 66	3,804 66	1,767 26	1,455 13	2,370 68	3,825 81	6,166 00	20,000 00	500 00	13,834 00
Plymouth, . . .	600 00	188 00	568 50	10,007 51	11,364 01	3,446 90	2,682 67	8,669 08	11,351 75	100 00	29,000 00	1,000 00	30,000 00
Marshfield, . .	600 00	-	164 00	3,860 69	4,624 69	1,286 00	855 88	3,468 81	4,624 69	4,830 10	11,350 00	995 00	7,514 90
Barnstable, . .	600 00	-	48 00	591 20	1,239 20	946 00	625 50	601 92	1,227 42	1,600 00	6,000 00	200 00	4,600 00
Nantucket, . .	517 00	23 40	44 00	307 93	892 33	1,029 00	528 00	212 02	740 00	-	2,300 00	640 96	2,940 96
Martha's Vineyard, .	600 00	120 50	43 67	383 25	1,147 42	835 25	615 00	738 29	1,635 84	350 00	3,500 00	2,000 00	5,150 00
Totals, . . .	$17,917 00	$11,152 29	$7,424 99	$96,111 33	$138,471 50	$54,295 21	$41,902 91	$72,318 16	$129,704 94	$195,386 48	$638,350 00	$112,576 36	$494,269 79

PERMANENT FUND—HOW INVESTED.

MASSACHUSETTS.—In stocks, bonds and Mass. Hospital Life Ins. Co.
ESSEX.—In Bank Stock, R. R. bonds and farm.
MIDDLESEX.—In real estate and fixtures.
MIDDLESEX NORTH.—In lands, buildings and personal property.
MIDDLESEX SOUTH.—In Society's buildings, covered pens, horse-stalls, park, grounds and fixtures.
WORCESTER.—In real estate.
WORCESTER WEST.—In real estate.
WORCESTER NORTH.—In real estate and exhibition buildings.
WORCESTER NORTH-WEST.—In grounds and buildings and personal property.
WORCESTER SOUTH.—In grounds, hall, furniture, &c.
WORCESTER SOUTH-EAST.—In personal property, real estate, &c.
HAMPSHIRE, FRANKLIN & HAMPDEN.—In real estate.
HAMPSHIRE.—In land, buildings, tracks, fixtures, &c.
HIGHLAND.—In savings bank, mortgage, and membership notes.
HAMPDEN.—In real estate.
HAMPDEN EAST.—In fair grounds, exhibition building, deposit in bank, &c.
UNION.—In real estate and personal property.
FRANKLIN.—In grounds, bank stock and furniture.
DEERFIELD VALLEY.—In real estate.
BERKSHIRE.—In real estate.
HOOSAC VALLEY.—In real estate
HOUSATONIC.—In real estate and notes of members.
NORFOLK.—In real estate occupied by the Society.
HINGHAM.—In buildings and grounds.
BRISTOL.—In real estate.
BRISTOL CENTRAL.—In real estate.
PLYMOUTH.—In real estate, fixtures and furniture.
MARSHFIELD.—In grounds, buildings, furniture, &c.
BARNSTABLE.—In land and buildings.
NANTUCKET.—In grounds, hall and fixtures and deposits in savings bank.
MARTHA'S VINEYARD.—In agricultural hall and land, and notes of members.

ANALYSIS OF PREMIUMS AND GRATUITIES AWARDED.

FARMS.

SOCIETIES.	For management of farms.	For experiments in draining.	For subsoiling.	For ploughing at exhibition.	For reclaiming swamp lands.	For experiments with manures.	For spading.	For hedges and ornamental trees.	For reclaiming old pastures.	For orchards of all kinds.	For cranberries.	For other farm improvements.	Total amount offered for farm improvements.	Total am't awarded for farm improvements.	Total am't actually paid for farm improvements.
Massachusetts,	-	-	-	-	-	$313 71	-	-	-	-	-	-	-	-	-
Essex,	-	-	-	$124 00	-	-	-	-	-	-	$15 00	-	$369 00	$139 00	$124 00
Middlesex,	-	-	-	64 00	-	-	-	-	-	-	-	$20 00[1]	-	-	-
Middlesex North,	$50 00	-	-	27 00	-	-	-	-	-	-	14 00	-	170 00	91 00	84 00
Middlesex South,	-	-	-	75 00	-	-	-	-	-	-	1 00	-	190 00	76 00	76 00
Worcester,	-	-	-	95 00	-	-	-	-	-	-	-	-	95 00	95 00	96 58
Worcester West,	-	-	-	69 00	-	-	-	-	-	-	-	-	129 00	69 00	69 00
Worcester North,	-	-	-	44 00	-	-	-	-	-	-	-	-	386 00	20 00	20 00
Worcester North-West,	-	-	-	13 00	-	-	-	-	-	-	-	-	13 00	13 00	13 00
Worcester South,	-	-	-	64 00	-	-	-	-	-	-	2 25	-	185 00	66 25	66 25
Worcester South-East,	10 00	-	-	94 00	-	-	-	-	-	-	-	-	253 00	-	-
Hampshire, Franklin & Hampden,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hampshire,	-	-	-	-	-	-	-	-	-	-		5 00	5 00	5 00	4 00
Highland,	-	-	-	-	-	-	-	-	-	$2 00	-	-	15 00	2 00	2 00
Hampden,	-	-	-	-	$14 00	-	-	-	-	-	1 50	-	121 50	15 50	15 50

Hampden East,	-	-	-	$44 00	-	-	-	-	-	-	$0 50	-	$228 75	$44 50	$44 50
Union,	$16 00	-	-	-	-	-	-	-	-	$6 00	-	$12 00	60 00	34 00	34 00
Franklin,	-	-	-	-	$6 00	-	-	-	-	-	-	-	54 00	6 00	6 00
Deerfield Valley,	-	$10 00	-	-	-	-	-	-	$7 00	.	7 00	-	50 00	24 00	24 00
Berkshire,	50 00	-	-	28 00	10 00	$18 00	-	-	-	54 00	-	-	183 00	160 00	160 00
Hoosac Valley,	40 00	6 00	-	-	5 00	9 00	-	-	-	15 00	-	-	96 00	75 00	75 00
Housatonic,	180 00	-	-	50 00	-	-	-	-	-	42 00	-	-	291 00	272 00	272 00
Norfolk,	-	-	-	55 00	-	-	-	-	-	-	-	-	406 00	55 00	60 00
Hingham,	-	-	-	25 00	-	-	$6 00	-	-	-	-	-	140 00	31 00	31 00
Bristol,	-	-	-	222 00	-	-	-	-	-	10 00	-	30 00	45 00	40 00	40 00
Bristol Central,	-	-	-	50 00	-	-	-	-	-	-	-	-	79 00	50 00	-
Plymouth,	-	-	-	78 00	-	-	-	-	-	-	45 00	-	264 00	123 00	123 00
Marshfield,	-	-	-	39 00	-	-	-	-	-	10 00	10 00	3 00	137 00	62 00	62 00
Barnstable,	-	-	-	25 00	-	-	-	-	-	-	4 75	-	128 00	29 75	29 75
Nantucket,	-	-	-	14 00	-	-	-	-	-	-	-	-	112 00	14 00	14 00
Martha's Vineyard,	-	-	-	10 00	-	-	-	-	-	-	4 00	9 45	-	23 45	20 70
Totals,	$346 00	$16 00	-	$1,329 00	$35 00	$340 71	$6 00	-	$7 00	$139 00	$105 00	$79 45	$4,205 25	$1,645 45	$1,566 28

[1] Vineyards.

Analysis of Premiums and Gratuities Awarded—Continued.

FARM STOCK.

SOCIETIES.	For Bulls.	For Milch Cows.	For Heifers.	For Calves.	For Working Oxen.	For Steers.	For Fat Cattle.	For Horses.	For Sheep.	For Swine.	For Poultry.	All other Stock.	Total amount offered for Live Stock.	Total amount awarded for Live Stock.	Total amount paid out for Live Stock.
Massachusetts, . .	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Essex, ...	$30 00	$65 00	$36 00	$10 00	$40 00	$16 00	$18 00	$213 00	$17 00	$8 00	$76 00	$50 00	$ 72 00	$579 00	$510 90
Middlesex, . .	18 00	97 00	17 00	8 00	10 00	-	-	209 00	4 00	36 00	81 00	-	960 00	550 00	352 00
Middlesex North, .	39 00	50 00	33 00	-	50 00	13 00	14 00	173 00	14 00	15 00	59 00	3 00	738 00	463 00	364 09
Middlesex South, .	20 00	34 00	34 00	9 00	24 00	-	18 00	406 00	-	42 00	116 00	-	958 00	703 00	661 00
Worcester, . .	150 00	172 00	125 00	18 00	171 00	58 00	32 00	314 00	22 00	37 00	24 00	216 00	1,759 00	1,492 00	1,492 00
Worcester West, .	46 00	98 00	20 00	30 00	60 00	56 00	52 00	734 00	16 00	35 00	21 50	65 00	1,467 00	1,244 50	1,210 25
Worcester North, .	16 00	33 00	38 00	15 00	25 00	24 00	19 00	153 00	32 00	24 00	62 00	84 00	645 00	525 00	525 00
Worcester N'th-West,	25 00	35 00	37 00	13 00	19 00	30 00	37 00	145 00	11 00	17 00	14 00	77 00	589 00	460 00	422 00
Worcester South, .	54 00	45 00	33 00	18 00	54 00	55 00	34 00	563 00	13 00	17 00	7 00	95 00	1,128 50	988 00	988 00
Worcester S'th-East,	28 00	25 00	21 00	4 00	55 00	45 00	8 00	97 00	-	45 00	17 50	-	522 00	376 00	300 00
Hampshire, Franklin & Hampden, . .	89 00	30 00	71 00	24 00	64 00	27 00	117 00	231 00	45 00	32 00	3 50	345 00	797 00	1,078 50	906 50
Hampshire, . .	22 00	12 50	6 00	13 00	13 50	5 00	12 00	140 00	33 00	28 00	29 50	133 63	530 00	448 13	401 58
Highland, . . .	26 00	29 00	16 25	4 25	34 00	22 50	6 00	134 00	45 00	6 00	1 75	50 00	466 50	374 75	374 75

Hampden, . . .	$75 00	$53 00	$63 00	$21 00	$43 00	$32 00	$41 00	$110 00	-	$5 00	$46 00	-	$817 00	$489 00	$457 50
Hampden East, .	22 00	38 00	15 00	5 00	37 00	42 00	29 00	303 00	$20 00	20 00	11 00	$25 00	758 00	567 00	546 50
Union, . . .	10 00	30 00	17 25	6 00	47 00	20 50	21 00	94 00	4 00	6 00	6 00	67 00	523 25	328 75	328 75
Franklin, . . .	47 00	125 00	22 00	12 00	30 00	64 00	18 00	210 00	102 00	26 00	21 50	90 00	854 00	766 50	746 75
Deerfield Valley, .	25 00	2 00	12 00	17 00	56 00	35 00	-	124 00	52 00	14 00	13 00	66 00	490 00	428 00	376 00
Berkshire, . . .	94 00	181 00	64 00	24 00	37 00	34 00	18 00	248 00	73 00	39 00	44 00	36 00	1,214 00	892 00	892 00
Hoosac Valley, . .	21 00	42 00	14 00	9 00	27 00	7 00	19 00	188 00	149 00	19 00	50 00	4 00	745 00	549 00	546 00
Housatonic, . .	60 00	99 00	36 00	15 00	63 00	41 00	22 00	205 00	115 00	32 00	51 00	73 00	962 00	812 00	812 00
Norfolk, . . .	47 00	101 00	23 00	-	-	-	-	202 00	-	77 00	177 00	-	1,080 00	627 00	556 50
Hingham, . . .	65 00	104 00	67 00	40 00	30 00	7 00	42 00	68 00	41 50	47 50	62 50	-	890 00	574 50	574 50
Bristol, . . .	105 00	281 00	83 00	48 00	150 00	51 00	104 00	260 00	41 00	52 00	110 50	-	1,859 75	1,285 50	1,275 00
Bristol Central, .	113 00	54 00	-	79 00	80 00	-	33 00	167 00	37 00	78 00	110 25	-	782 00	751 25	-
Plymouth, . . .	94 88	160 00	57 00	72 80	64 00	41 00	81 72	194 00	55 20	57 00	78 00	50 00	1,076 00	970 60	970 60
Marshfield, . .	19 00	42 00	37 00	12 00	19 00	6 00	15 00	93 50	9 00	17 00	43 00	-	402 50	312 50	312 50
Barnstable, . .	17 00	3 00	22 00	7 00	20 00	7 00	34 00	48 00	10 50	31 00	35 00	-	290 00	234 50	234 50
Nantucket, . .	26 00	83 00	27 50	2 50	16 00	10 00	3 00	50 00	25 00	8 00	24 00	-	565 00	275 00	275 00
Martha's Vineyard, .	-	17 00	30 55	3 00	17 00	21 00	24 00	48 00	29 00	7 00	23 00	23 00	358 75	242 55	232 00
Totals, . .	$1,403 88	$2,141 50	$1,077 55	$539 55	$1,365 50	$772 00	$871 72	$6,123 50	$1,015 20	$877 50	$1,417 50	$1, 52 63	$24,099 25	$20,190 53	$18,043 18

Analysis of Premiums and Gratuities Awarded—Continued.

FARM PRODUCTS—Continued.

SOCIETIES.	Indian Corn.	Wheat.	Rye.	Barley.	Oats.	Beans.	Grass Crops.	Grass-seeds.	Potatoes.	Carrots.	Beets.	Parsnips.	English Turnips.	Ruta-bagas.	Onions.	Other Root Crops and Vegetables.
Massachusetts,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Essex,	$10 00	-	$10 00	-	-	-	-	-	-	-	-	-	-	-	$10 00	$86 00
Middlesex,	3 00	$3 00	3 00	-	$4 00	$5 00	-	-	$10 00	$10 00	$8 00	$5 00	$5 00	$5 00	10 00	23 00
Middlesex North,	5 00	-	3 00	-	-	6 00	-	-	-	-	-	-	-	-	-	24 00
Middlesex South,	10 00	1 00	1 50	$1 00	1 00	-	-	-	8 50	50	75	75	-	25	2 00	53 00
Worcester,	5 00	2 00	6 00	1 00	3 00	-	-	-	6 00	1 00	1 00	-	-	1 00	1 00	6 00
Worcester West,	-	-	-	-	-	-	-	-	1 00	-	-	-	-	-	-	14 00
Worcester North,	10 00	18 00	-	-	-	50	-	-	3 00	-	1 25	-	75	1 00	1 25	12 00
Worcester North-West,	1 00	3 00	-	3 00	3 00	1 00	-	-	3 00	-	1 00	-	1 00	-	1 00	8 00
Worcester South,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Worcester South-East,	-	-	-	-	-	-	-	-	-	-	-	-	4 00	-	3 00	37 50
Hampshire, Franklin & Hampd'n,	-	1 50	-	-	-	-	-	-	1 50	-	-	-	-	-	-	14 50
Hampshire,	6 00	5 00	3 00	-	2 00	1 00	-	-	6 00	3 00	3 00	2 00	3 00	3 00	3 00	5 00
Highland,	9 50	-	-	3 00	6 00	1 00	-	-	9 00	6 00	6 00	-	2 00	5 00	1 00	19 75
Hampden,	4 50	-	-	-	-	-	-	$6 00	18 75	-	-	-	75	-	25	10 00

Hampden East,	$1 75	-	-	-	$0 50	$2 00	-		$2 50	$6 50	$0 75	$0 50	$0 75	$0 50	$2 00	$14 00
Union,	9 00	-	-	-	3 00	-	$5 00	-	6 00	-	8 00	-	5 00	-	6 00	21 25
Franklin,	*3 50	$5 00	-	-	-	-	-	-	11 50	5 00	-	-	-	-	7 00	14 00
Deerfield Valley,	-	1 00	$0 75	$0 50	50	-	-	$0 25	10 25	50	20	-	1 30	3 20	1 25	6 00
Berkshire,	65 00	20 00	84 00	42 00	84 00	5 00	12 00	11 00	75 00	9 00	12 00	-	11 00	12 00	7 00	55 00
Hoosac Valley,	28 00	5 00	12 00	15 00	21 00	6 00	20 00	45 50	28 00	3 00	6 00	-	6 00	-	6 00	32 00
Housatonic,	102 00	37 00	76 00	20 00	60 00	6 00	36 00	6 00	29 00	5 00	14 00	-	9 00	9 00	-	56 00
Norfolk,	-	-	-	-	-	-	-	-	-		-	-	-	-	-	117 00
Hingham,	12 00	-	-	-	-	-	-	-	-	-	-	-	-	13 00	-	40 30
Bristol,	25 00	-	-	-	-	-	12 00	-	15 00	-	11 00	-	5 00		-	114 75
Bristol Central,	25 00	-	-	-	-	10 00	-	-	-	6 00	10 00	-	-	10 00	-	14 50
Plymouth,	45 00	-	20 00	-	12 00	-	-	-	8 00		-	-	-	-	8 00	52 25
Marshfield,	22 75	-	-	-	-	1 00	-	-	11 25	50	2 50	-	2 25	-	5 00	75 25
Barnstable,	†6 75	-	-	-	-	-	-	-	-	-		-	-	-	-	34 75
Nantucket,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31 75
Martha's Vineyard,	4 95	-	70	20	6 45	4 50	7 00	-	14 05	15	2 55	-	1 45	-	1 40	8 00
Totals,	$414 70	$101 50	$219 95	$85 70	$206 45	$49 00	$92 00	$68 75	$267 30	$56 15	$88 70	$8 25	$58 20	$62 95	$75 15	$999 55

* Seed Corn.

† Specimens of Grain.

Analysis of Premiums and Gratuities Awarded—Continued.

FARM PRODUCTS—Concluded.

SOCIETIES.	Total am't offer-ed for Grain and Root Crops.	Tot'l am't award-ed for Grain and Root Crops.	Total am't paid out for Grain and Root Crops.	Fruits.	Flowers.	Any other culti-vated crops.	Butter.	Cheese.	Preserved Fruits and Vegetables.	Wheat Bread.	Rye and Indian Bread.	Corn Bread.	Tot. am't paid out under the head of Farm Products.
Massachusetts,	-	-	-	$500 00	-	-	-	-	-	-	-	-	-
Essex,	$170 00	$116 00	$112 00	221 50	$35 00	-	$27 00	-	$20 00	-	-	-	$385 00
Middlesex,	220 00	225 00	62 00	270 00	123 00	-	24 00	-	29 00	$36 00	$18 00	-	283 50
Middlesex North,	76 00	52 00	37 00	126 25	34 75	$9 00	23 00	-	-	12 00	6 00	-	186 50
Middlesex South,	222 75	82 25	76 25	83 75	39 00	-	12 00	-	20 00	9 00	4 00	-	233 00
Worcester,	57 50	43 00	43 00	61 00	15 00	-	33 00	-	32 00	4 50	3 50	-	192 00
Worcester West,	52 00	-	-	56 50	18 00	-	10 00	$47 00	-	6 00	6 00	-	147 50
Worcester North,	82 00	67 00	67 00	55 00	30 00	-	20 00	3 00	3 50	7 00	5 50	-	191 00
Worcester North-West,	35 00	25 00	22 00	22 00	9 00	8 00	9 00	11 00	-	3 00	2 00	-	71 67
Worcester South,	50 00	-	-	29 75	10 25	18 25	9 00	14 00	-	12 00	6 00	-	99 25
Worcester South-East,	102 00	44 50	15 00	77 40	9 25	-	18 00	-	9 65	6 00	2 00	-	111 50
Hampshire, Franklin & Hamp'n,	82 00	-	-	44 25	19 00	-	11 50	4 00	5 50	4 50	-	-	106 25
Hampshire,	48 00	45 00	34 00	55 50	37 25	11 00	14 00	9 00	11 75	3 50	3 00	$3 50	171 75
Highland,	78 50	67 25	67 25	10 50	5 00	3 00*	6 50	5 00	2 25	1 40	3 65	-	104 55

Hampden,	$68 00	$40 25	$37 50	$48 50	$8 00	-	$20 00	-	$3 00	$4 00	$3 00	$2 00	$115 00
Hampden East,	126 00	31 75	31 50	25 00	15 75	$5 25	10 00	$9 00	5 00	3 00	3 00	3 80	79 62
Union,	121 50	63 25	63 25	14 75	5 25	6 00	4 50	9 00	6 00	4 00	3 00	3 00	118 75
Franklin,	56 50	46 00	46 00	81 50	41 00	-	21 00	21 00	12 50	7 00	6 00	12 00	10 00†
Deerfield Valley,	67 00	20 40	20 10	21 00	4 75	3 50	10 00	6 00	3 50	5 25	4 50	6 50‡	94 14
Berkshire,	637 00	504 00	504 00	83 00	27 00	105 00	41 00	53 00	15 00	30 00	10 00	10 00	878 00
Hoosac Valley,	185 00	153 00	153 00	59 00	9 00	36 00	38 00	30 00	22 50	13 50	6 50	-	448 00
Housatonic,	554 00	466 00	466 00	146 00	38 00	15 00	36 00	36 00	-	12 00	6 00	6 00	761 00
Norfolk,	117 00	117 00	63 00	177 00	59 50	-	31 00	-	10 00	12 75	5 00	-	297 00
Hingham,	196 00	65 30	65 30	109 75	36 10	4 50	29 50	13 00	16 05	9 00	7 50	-	290 70
Bristol,	161 00	51 00	51 00	102 00	40 50	-	46 00	14 00	6 00	13 25	3 25	-	665 75
Bristol Central,	159 00	75 50	-	83 00	-	15 00	17 00	6 00	6 50	10 00	5 00	-	142 50
Plymouth,	223 00	145 25	145 25	98 25	79 50	-	39 00	39 00	-	63 00‡	-	-	313 75
Marshfield,	231 00	120 50	120 50	65 50	29 75	-	15 00	15 00	24 70	5 50	3 00	-	278 95
Barnstable,	113 00	41 50	41 50	60 75	25 75	-	12 00	7 00	10 00	6 00	6 00	5 00‡	174 00
Nantucket,	135 00	-	-	63 75	19 00	-	14 00	-	1 00	4 50	-	-	134 00
Martha's Vineyard,	161 00	60 05	55 00	56 50	6 75	-	12 75	2 00	31 75	5 05	4 00	2 50	176 50
Totals,	$4,586 75	$2,797 75	$2,367 30	$2,928 65	$825 10	$239 50	$611 75	$353 00	$307 15	$312 70	$135 40	$54 00	$7,271 13

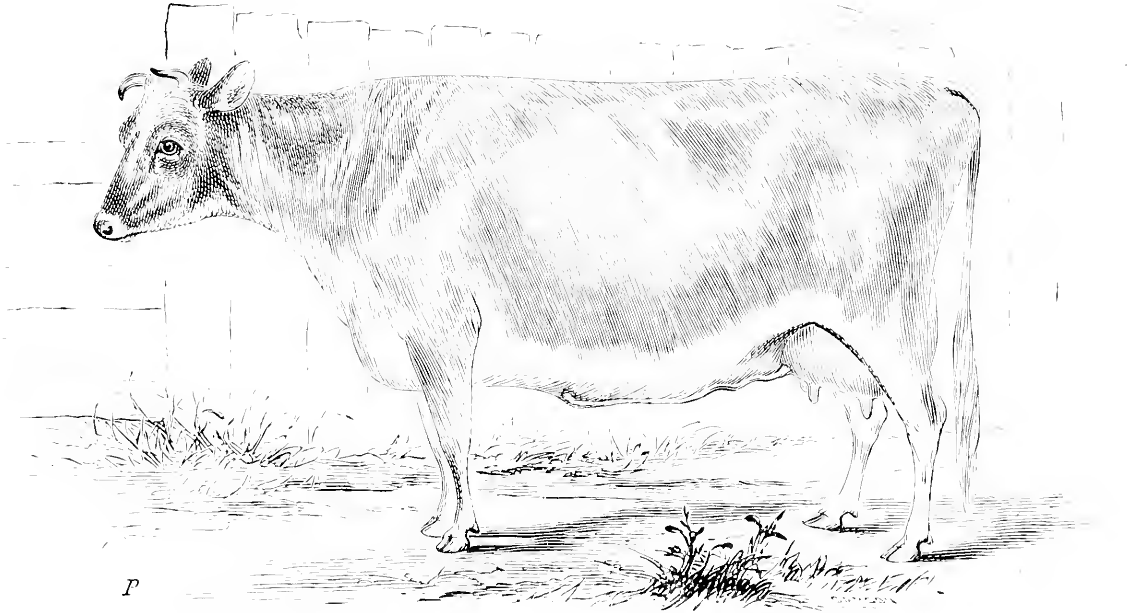
* Maple sugar. † Honey, maple syrup, wine, &c. ‡ Sundries.

ANALYSIS OF PREMIUMS AND GRATUITIES AWARDED—Concluded.

MISCELLANEOUS.

SOCIETIES.	For agricultural implements.	Offered for raising forest trees.*	For experiments on manures.	Amount awarded for objects strictly agricultural not specified above.	Amount awarded and paid out for Trotting-horses.	For objects not strictly agricultural, domestic manufactures, etc.	No. of persons who received premiums and gratuities.
Massachusetts,	-	-	-	-	-	$3,216 00	-
Essex,	$36 00	$30 00	$25 00	$25 00	-	121 00	-
Middlesex,	66 00	-	-	-	-	186 50	230
Middlesex North,	30 00	-	-	-	-	-	145
Middlesex South,	2 00	60 00	-	-	$250 00	76 75	141
Worcester,	-	22 00	-	-	910 00	20 25	160
Worcester West,	3 00	30 00	10 00	-	525 00	94 55	189
Worcester North,	16 00	50 00	90 00	20 00	-	286 50	187
Worcester North-West,	1 50	30 00	-	-	630 00	180 00	146
Worcester South,	-	35 00	-	-	-	50 00	140
Worcester South-East,	14 50	30 00	-	5 00	660 00	9 50	365
Hampshire, Franklin & Hampden,	61 50	20 00	-	-	375 00	-	208
Hampshire,	14 50	16 00	-	-	215 00	118 48	194
Highland,	16 00	-	-	-	30 00	97 25	169
Hampden,	14 00	15 00	-	-	-	88 50	71
Hampden East,	14 00	25 00	60 00	-	150 00	77 90	115
Union,	-	-	-	3 75	33 00	63 00	158
Franklin,	16 00	10 00	5 00	-	31 00	113 00	282
Deerfield Valley,	10 50	7 00	-	3 25	12 00	104 25	283
Berkshire,	59 00	-	-		400 00	413 00	580
Hoosac Valley,	24 00	-	14 00	28 00	967 50	222 00	340
Housatonic,	49 00	-	-	-	525 00	336 00	395
Norfolk,	-	15 00	20 00	-	365 00	47 15	183
Hingham,	10 00	-	-	12 50	-	322 75	-
Bristol,	-	30 00	60 00	2,517 00	1,590 50	230 25	584
Bristol Central,	13 00	-	-	-	542 00	193 01	206
Plymouth,	15 00	60 00	-	22 00	580 00	198 07	280
Marshfield,	11 00	50 00	-	20 00	-	171 43	477
Barnstable,		7 00	12 00	-	50 00	137 25	329
Nantucket,	-	13 00	16 00	-	-	105 65	133
Martha's Vineyard,	-	25 00	-	-	18 00	186 00	261
Totals,	$496 50	$580 00	$312 60	$2,656 50	$8,855 00	$7,465 99	6,953

* Awarded for the same by the Bristol Society, $30.00.



JERSEY COW,

"DAISY OF DEERFOOT."

OWNED BY EDWARD BURNETT, "DEERFOOT FARM," SOUTHBOROUGH, MASS.—See Preface to Second Part.

First Premium at N. Y. State Fair, Albany, 1873.

ABSTRACT OF RETURNS

OF THE

AGRICULTURAL SOCIETIES

OF

MASSACHUSETTS.

1873.

EDITED BY

CHARLES L. FLINT,

SECRETARY OF THE STATE BOARD OF AGRICULTURE.

BOSTON:

WRIGHT & POTTER, STATE PRINTERS,

CORNER OF MILK AND FEDERAL STREETS.

1874.

PREFACE.

Owing to the unusual length of the first part of this volume, or the Report of the Board, it has been found necessary to condense the papers returned in the transactions of the various Agricultural Societies in order to keep the work within reasonable limits. When the exceptionally high character and value of most of the papers of the Report itself are considered, the necessity for this condensation will hardly be regretted, though some papers do not appear in the following pages that would otherwise have been used.

I am indebted to the Messrs. STURTEVANT BROTHERS, of South Framingham, for the admirable likeness of the Ayrshire cow "Georgie," and to EDWARD BURNETT, Esq., of Southborough, for that of his first-prize cow "Daisy of Deerfoot."

"Georgie" was bred by James Wilson, Boghall, Houston, Renfrewshire, Scotland, and was imported in April, 1871. When two years old, she was first at Houston; she gained a medal for best cow in the yard, beating the cow which, the preceding year, took the £25 challenge-cup at Stirling. When four years old, she gained first prize at Houston, likewise medal for best cow in the yard; and at Renfrewshire county show she was again first, beating a second time the challenge-cow. Calved spring of 1866. Has been exhibited but once in America, at the New York State Agricultural Society Fair at Albany, 1873, when she received the first prize, thirty-two entries (nineteen competing) in her class. Arrived at Waushakum Farm June 15 (412 miles by rail), 1871. Yield, 6½ months, ending January 1, 1872 (calved May 13), 4,600 lbs. January 1, 1872, to January 1, 1873 (calved January 27), 7,127 lbs. January 1, 1873, to January 1, 1874 (calved August 1), 6,094½ lbs. Weight, September 1872, 890 lbs.

"Daisy of Deerfoot" (3182), American Herd Register. This family has always been remarkable for its combined quality and quantity of milk. Last September, two months after calving, "Daisy of Deerfoot" gave twenty-two per cent. of cream in a test-tube twenty-four hours after setting. Her dam, "Fanny" (675), was imported in 1854, and her owner, Mr. JOSEPH BURNETT, in a careful debtor and creditor account, was able to credit her with upwards of $1,500.

Both "Georgie" and "Daisy of Deerfoot" were exhibited at the Fair of the New York State Agricultural Society at Albany in 1873, and received the first prizes in their respective classes, and that against the strongest competition.

CHARLES L. FLINT.

BOSTON, January, 1874.

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MARTHA'S VINEYARD.

President—CONSTANT NORTON, of Edgartown.
Secretary—WILLIAM J. ROTCH, of Tisbury.

AGRICULTURAL EXHIBITIONS—1874.

ESSEX, at *Danvers*, ...	September 29 and 30.
MIDDLESEX, at *Concord*, ...	September 29 and 30.
MIDDLESEX NORTH, at *Lowell*, . . .	September 24 and 25.
MIDDLESEX SOUTH, at *Framingham*, . .	September 22 and 23.
WORCESTER, at *Worcester*, ...	September 17 and 18.
WORCESTER WEST, at *Barre*, . . .	September 24 and 25.
WORCESTER NORTH, at *Fitchburg*, . .	September 29 and 30.
WORCESTER NORTH-WEST, at *Athol*, . .	October 6 and 7.
WORCESTER SOUTH, at *Sturbridge*, . .	September 10 and 11.
WORCESTER SOUTH-EAST, at *Milford*, .	September 30 and October 1 and 2.
HAMPSHIRE FRANKLIN AND HAMPDEN, at *Northampton*, ...	October 7, 8 and 9.
HAMPSHIRE, at *Amherst*, ...	September 29 and 30.
HIGHLAND, at *Middlefield*, ...	September 10 and 11.
HAMPDEN, at *Westfield*, ...	October 6 and 7.
HAMPDEN EAST, at *Palmer*, ...	October 13 and 14.
UNION, at *Blandford*, ...	September 16 and 17.
FRANKLIN, at *Greenfield*, ...	September 24 and 25.
DEERFIELD VALLEY, at *Charlemont*, . .	September 29 and 30.
BERKSHIRE, at *Pittsfield*, ...	October 6 and 7.
HOUSATONIC, at *Great Barrington*, . .	September 30 and October 1.
HOOSAC VALLEY, at *North Adams*, . .	September 22 and 23.
NORFOLK, at *Readville*, ...	September 24 and 25.
BRISTOL, at *Taunton*, ...	September 29 and 30.
BRISTOL CENTRAL, at *Myrick's*, . . .	September 16 and 17.
PLYMOUTH, at *Bridgewater*, ...	September 18, 19 and 20.
HINGHAM, at *Hingham*, ...	September 23 and 24.
MARSHFIELD, at *Marshfield*, ...	October 7, 8 and 9.
BARNSTABLE, at *Barnstable*, ...	September 15 and 16.
NANTUCKET, at *Nantucket*, ...	September 30 and October 1.
MARTHA'S VINEYARD, at *West Tisbury*, .	October 6, 7 and 8.

AGRICULTURE OF MASSACHUSETTS.

DEBT AND SUCCESS.

From an Address before the Worcester Agricultural Society.

BY GEORGE S. BOUTWELL.

It has been said, in another form of expression, that the slightest excess of expenses over income is poverty, and that the slightest excess of income over expenses is wealth. The ability of practical farmers to master this great problem of life is not so much dependent upon what they know of their business as upon their faculty to apply what they know. Success in business is due to administration. Capacity in administration is due to that faculty, power or quality, called common sense, which everybody speaks well of and nobody understands precisely. We infer its presence or its absence from the results of a man's life. I venture upon a definition of the phrase I am using, not so much for the purpose of making its meaning clear as for the purpose of giving it a loftier place in your thoughts. Common sense is a degree, a high degree,—in fine, the highest degree,—of human wisdom applied to practical things. It is not learning, it is not knowledge; it is rather the faculty of applying what we know to what we do. Other things being equal, the practical farmer who knows the most will do the best; but other things not being equal, a man who excels in wisdom in administration may surpass a man of greater learning, or even one of greater knowledge of things. But do not allow this suggestion to lead you to place a lower estimation upon learning, whether general or professional; for culture of every sort gives us

capacity to appreciate wisdom, and opportunity also for its exercise.

The details of farm administration, whether for approval or criticism, are too minute for notice in a public address; but there are two features of opinion and practice so general as to deserve consideration. With few exceptions, farmers look for success by curtailing their operations instead of enlarging them. In this they differ from the mechanic, the manufacturer and the merchant. The leader in these pursuits seeks to enlarge his business, increase the number of his workmen, and multiply his customers. He is content to add his earnings and profits to his capital employed. It is bad policy for a merchant or manufacturer to withdraw his profits and invest in shares, bonds or loans. He adds his annual profits to his capital and measures his prosperity by the increase of his business. But the farmer measures his prosperity by the additions he makes to the available capital of other people, whose risks he takes, but whose business he can neither understand nor control. If a farmer, at the end of a year, finds himself in funds over his expenses, is not the fact established that farming with him is profitable? And is not the inference a just one that the use of his surplus would increase his profits in the future proportionately? But more than this is true. There are certain and considerable farm expenses that are not proportionate to the receipts. There are fences to build and repair, ditches to cut, pastures to clear of brush, and other daily work is to be done, insignificant in detail, but important in the aggregate, that is determined mainly by the size of the farm, and bears but a slight relation to its products. These expenses are inevitable. I connect this statement with another susceptible of proof.

Every farm crop, estimated by the per cent., is exceedingly profitable. This is true of market vegetables, fruits of every variety, hay, the dairy, and of Indian corn even in New England.

Let any farmer state an account with each particular crop, and he will find his per cent. of profit so large that he would become a millionaire in five years if his aggregate business were only one-tenth as large as that of the leading merchants and manufacturers of the country.

Let me give an actual case in support and illustration of my statement. One acre of land in grass is estimated to be worth two hundred dollars. The charges would be :—

Interest, ...	$16 00	
Taxes, ...	3 00	
Fences, ...	5 00	
Manure, ...	25 00	
Harvesting hay, ...	20 00	
		$69 00
Crop, four tons of hay, worth . . .		100 00

My neighbor, with moderate mental toil, and with but little physical exercise, has annually wrought out this result for six years, and he has as good security as we have for the return of the seasons that he may go on with the same results to the end of his life.

I connect these statements with a third :—There is no farm in Massachusetts of more than ten acres in extent that is not capable of yielding twice what it yields at present.

Assuming that the inevitable expenses of a farm are fixed by its size rather than by its products, and that the per cent. of profits upon a statement of the cost of particular crops is very large, is it not clear that the secret of success is to increase the products? and is it not clear that this can be done only by increasing the investment of labor and capital? In all that I have said upon this point I have assumed that money is dear and that labor is dear; but the answer to the farmer is, "So are your products dear." The margin of difference for the farmer in Eastern Massachusetts is greater than ever before, and now is the time, gentlemen, for extending your business.

I do not imagine that Massachusetts farmers are generally in debt; but I am quite sure that some of them have applied their annual earnings to the payment of mortgages, when the money could have been more profitably used for the improvement of their farms. It may seem strange that I should suggest that it is not wise always and under all circumstances to pay debts.

It is told of Mr. Webster,—but whether with any founda-

tion in truth, I cannot say,—that in a speech at Philadelphia, on a festive occasion, when Pennsylvania was embarrassed and her credit impaired, he insisted that her public debt must be paid. Warmed by the occasion and subject, he said: "The debt of Pennsylvania must be paid; it shall be paid, if I pay it myself;" and then, after a little delay, he added, "but as to private indebtedness, that is a different thing."

Private indebtedness, gentlemen, under some circumstances, is a different thing from a public debt. I do not speak of the obligation, but of the wisdow of delay, with the consent of the creditor. Public debts usually represent the cost of wars, of public buildings, of enterprises too vast for private undertaking. There are no available assets except the private property and the producing power of the people. Every delay shifts something of the burden from accumulated wealth to the wealth-producing classes. The interest on the public debt of England can be wrung largely from the laboring classes, but the principal could only be paid from the accumulated wealth, or from the income of the accumulated wealth of the country. The logic which forms the base of British policy on this subject is clear. The wealthy men of the country receive from the laboring classes interest at three per cent. upon a debt which they themselves ought to pay. Hence the policy of Great Britain, dictated by the wealthy classes,—no surplus income, no payment of the public debt. Her example teaches that public debts ought to be paid, and paid with the least possible delay; but private indebtedness, under some circumstances, is a different thing.

If a farmer has half the sum of money necessary to buy a farm suited to his tastes and plans, there can be no doubt of the wisdom of the purchase. The debt is secure; it is represented by real property. There is hardly any responsibility attaching to the debtor. He enjoys the use of the land upon the payment of a certain annual rent, subject only to the chance of rise or fall in the value of the estate. Every improvement is for his benefit. The debt is an annual charge to the extent of the interest; nothing more. If the farmer can use his annual gains in the development of his farm, in the increase of his products, he adds to his wealth more rapidly than he would by the payment of the debt. The debt is

a fixed sum; the increase in the value of his farm shows his gains. It is certainly wiser to add to the value of the estate than to diminish the incumbrance, while the owner has not all the means in his business that he desires.

I have said that everybody speaks well of common sense, and that nobody understands exactly what it is; and I may now add that everybody speaks well of practical agriculture, and nearly everybody shuns it who can.

I fancy that mankind speak well of practical agriculture because they think it a useful pursuit, and not because they think it an agreeable or profitable one.

It is true that agriculture offers no temptation to those who seek large fortunes; its returns are constant and certain, but they are moderate.

It is also true that a young man who desires to become a farmer may often, perhaps generally, gain the means of doing so more rapidly in some other vocation. Let him take the best course that is open before him. Nor ought we to be disturbed by the fact that young men abandon the farms for other pursuits. If it be an evil, it is temporary, and tends to elevate agriculture by advancing the price of labor and the price of the products of labor.

Moreover, many of these men will return to the land in a few years with fresh interest and the means needed for its skilful and successful culture.

Practical agriculture is agreeable or otherwise as it is intellectual or otherwise. This is the rule of all pursuits. There are two classes of farmers, those who look on and those who work, and a few who both work and look on. Those who look on, whether working with their hands occasionally or not, find nothing disagreeable in farming. For them it compares favorably with similar situations in mills, mines and shops.

We have not yet reached the point in civilization and social equality when there are not persons compelled by their circumstances to work for wages—some on farms, some in mills, some in shops, and some in the mines. Farm laborers usually receive less wages than others, and their hours of labor are more; but the labor on a farm is varied and less exacting as to the time of execution, and also as to the force of mind and

body required at a given moment. The farmer's work is in the open air, while most artisans are confined to shops, mines, or mills. If farm wages are less than wages in other pursuits requiring no more physical or mental power, then farm wages are too low, and the movement from the farms to the cities and towns is a healthful one. You need not be disturbed, gentlemen, by the scarcity of laborers, or even by a reduction in the hours of labor. Your condition will be entirely satisfactory if only other farmers whose products come into competition with yours are subject to the same charges and deductions. This rule applies equally to manufacturers and producers of every kind. Farmers, producers and manufacturers may, without anxiety, see the rates of wages advance and the hours of labor diminish, if only similar changes take place at the same time over the whole field of competition. The increased cost, if the cost shall be increased, will be charged over to the consumers.

Finally, upon this point I venture the statement that farming offers more attractions than any other pursuit to laboring men of moderate means, provided always that they understand the business. If my view in regard to debt is accepted, a small capital will secure the possession and permanent control of a farm without financial danger or loss, while trade, commerce, and manufacturing require large investments with large risks. In these pursuits only a few persons can occupy the position of managers; the greater number—a hundred to one—are subordinates. Land is so cheap with us that its possession is not now an object of ambition; but the time is not distant when we shall clothe the possessor of land with something of the dignity that has been accorded to him in older countries, from Judea to Great Britain.

I turn for a moment to a topic familiar to us all,—scientific agricultural education. There is a struggle between intellect and money. In Europe, the struggle for centuries has been between money and mere numbers. For the most part, wealth has gained the mastery. Wealth gives position. Position is power. Intellect, too,—especially in this country,—gives position, and intellectual position is a greater power. Mere numbers will not give the body of American farmers permanently either power or position. They should be intellectual men,

and their calling should be made intellectual. Any calling that is followed by intellectual men is at once clothed with dignity, respectability and power. Ignorance is our common enemy. Farm labor, as labor merely, is not attractive. But to intellectual men, the field of examination, of experiment, of investigation, of test, is as large and as inviting as that occupied by Agassiz and his associates.

The extent to which we shall apply science to practical agriculture is the measure of the earth's practical capacity to support human beings. The desolation and depopulation of the countries east and south of the Mediterranean may be due to ignorance of an immutable law. If at the close of one harvest the land is less fertile than it was at the close of the preceding harvest, and so on, the end will be depopulation and waste; but if at the end of one harvest the land is more fertile than it was at the end of the preceding harvest, and so on, the results are wealth, prosperity, numbers, power. This truism is for individuals and for states.

CHINESE AGRICULTURE.

From an Address before the Hampden Agricultural Society.

BY CHAN LAISUN.

About two thousand years before the Christian era, the Chinese tribe settled in the land now known as the province of Shensi, where they increased greatly until they spread and occupied the whole eighteen provinces, which is now called China proper. The tribe remained a short time in the province of Shensi, the cradle of the Chinese empire, consolidating strength under their patriarchal chieftains, and gradually pushing themselves at every point of the compass, fighting against physical difficulties of the country. This people brought with them habits of settled labor, and an amount of civilization far superior to those who had preceded them, and thus they were able to subdue the land and replenish it. History shows that no sooner were they settled down in their new acquired territory than the arts of agriculture and weaving were displayed. The cultivation of grain for food and flax for clothing were the first objects of their solicitude. Silkworms and mulberry-trees were highly appreciated, and great care was bestowed on the rearing of them. It is said the Chinese were clothed with silk long before they had any knowledge of cotton, which valuable plant was introduced into China about 600 years ago from India. In addition to these endowments, the early Chinese possessed the elements of intellectual culture. They had a slight knowledge of astronomy; knew approximately the length of the year, and recognized the necessity of an intercalary month once every three years, to adjust the seasons, on which their process of agriculture depended. They possessed the elements of their present written hieroglyphical language, and as early as the

beginning of the Shang dynasty, B. C. 1765, one of the ministers of state presented a written memorial to his sovereign. With these superior endowments of mind, and the various elements of strength flowing from it, they have carried their civilization, both in the culture of the mind as well as of the soil, to such height, that, at one period of the world's history, China stood far above any other nation, and even to this day some of her arts and sciences are not superseded.

It is not our province to say much at this time of the Chinese elements of intellectual culture. But I wish to bring before you the industrial art of a people whose energies have been exerted for thousands of years in forcing the earth to yield its products to the support of a redundant population. Among the various branches of labor, agriculture holds the highest place in the estimation of the people. To make this labor honorable, the sovereign sets the example by appearing in person, early in spring, on the sacred field, and, with a highly ornamented plough drawn by an ox, he turns over three furrows, the princes of the royal blood five furrows, and, lastly, the high ministers of state nine furrows. This being done, the emperor and his ministers repair to a pavilion and remain there until the whole field is ploughed. The ceremony is of very ancient date, and takes place on the ground of the temple dedicated to heaven and earth at the capital of the empire. This crop, raised by his imperial majesty, is especially consecrated to the use of the gods. At this ceremony, a big ox made of clay, with a number of little ones, are carried in a procession to the sacred field. After the field is ploughed, these clay images are broken to pieces, and the multitude scramble for the broken bits, and scatter the ashes over their fields to insure an auspicious harvest. Throughout the provinces of the empire, civilians of high and low degree are also required to perform the same ceremony on the same day. Here the prefect and others, having turned the sod with the plough, return home; on the second day, they meet at early dawn in a temple dedicated to the god of grain, offer sacrifices, and repeat prayers, and perform series of prostrations. As soon as this religious rite is over, at a given signal the clay ox receives a blow on his forehead, when the crowd rushes to secure a piece of the image to strew on their fields. All lands are held as freehold as long

as the government receives its annual rent, either in specie or in kind, which is about one-tenth part of its produce. Owing to the redundant population very few farmers own more than two or three hundred acres. Some, indeed, own their eight hundred to a thousand acres, but these are exceptional cases. But millions and millions of them own ten or twenty acres. Thus, the Chinese are considered by Europeans more like gardeners than farmers.

The plains of the middle and southern provinces are made to yield two or three crops in rotation every year; at the north, only two. But when patches are laid out for raising vegetables, five, six, seven, and even eight crops are realized. The principal staples of production are: rice, tea, silk, cotton, hemp (which the Chinese make into grasscloth for dresses, of which there are three species, known by the botanical names of *Cannabis sativa*, *Sidi titiafolia*, *Netica nivea*), tobacco, indigo, sugar-cane, camphor, vegetable wax, bamboo, from which all paper is made, sweet and Irish potatoes, both foreign plants introduced into the country, the latter solely for European use. Our limited time will not permit us to go into details of the various manipulations of tea, silk, cotton and hemp—a species of flax. We all are aware of the great benefit these have conferred upon mankind throughout the world. We are sure that tea and silk can be made to grow upon American soil, especially in the regions of California, Texas, Arizona and New Mexico; but before you can afford to sell tea at ten or twelve cents a pound, it is useless to make an attempt. Tobacco is raised in great quantity, and some of very superior quality. It is smoked in pipes, very little being made into cigars; chewing is unknown. Nor have the Chinese arrived to that high state of civilization as to use the juice of this weed in daubing the beautiful silk dresses of the fair ladies.

The sugar-cane is principally raised in the southern provinces. Substitute manual labor for steam, the process of making sugar is the same in both countries, with this exception: the Chinese do not purify it with ox's blood, but press it with mud. It has not that crystalline appearance as the sugar made in this country. Camphor-trees grow in immense forests, and are of great height and dimensions. The process of making

camphor is like that of making maple-sugar from the maple-tree. The vegetable wax, which we get from the tallow-tree (*Stillingia sebifera*), is a tree grown over all the eastern part of China and some parts of the provinces bordering on Thibet and Burmah. An English traveller, describing it, says; "It is a beautiful tree, resembling the aspen in its shape and foliage; it would form a valuable addition to the list of shade-trees in this country. The seeds grow in clusters like ivy-berries, and are collected in November; when ripe the capsule divides, and, falling off, discovers two or three kernels covered with pure white tallow. When the tallow is to be prepared, these are picked from the stalks and put into an open wooden cylinder with a perforated bottom, in which they are well steamed over boiling-water. In ten or fifteen minutes the tallow covering the seeds becomes soft, and they are then thrown into a stone mortar and gently beaten with mallets to detach it. The whole is then sifted on a hot sieve, by which the tallow is separated from the kernels, though containing the brown skin which envelops the latter, and presenting a dirty appearance. The tallow in this state is inclosed in a straw cylinder, or laid upon layers of straw, held together by iron hoops, and subjected to pressure in a rude press, from which it runs clear in a semi-fluid state, and soon hardens into cakes. The candles made from it become soft in hot weather, and are sometimes coated by dipping them in wax."

The bamboo plant is cultivated almost everywhere; it is remarkable for its shade and beauty. There are about sixty varieties, different in size, according to its genus; ranging from that of a switch to a big pole, measuring from four to five inches in diameter. It is reared from shoots and suckers, and, after the root once clings to the ground, it thrives and spreads without further care or labor. Of these sixty varieties, each thrives best in a certain locality. And throughout the whole empire of China the bamboo groves not only embellish the gardens of the poor, but the vast parks of the princes and wealthy. The use to which this stately grass is put is truly wonderful. The tender shoots are cultivated for food like the asparagus; the roots are carved into fantastic images of men, birds, and monkeys. The tapering culms are used for all purposes that poles can be applied to,—in carrying, support.

ing, propelling, and measuring; by the porter, the carpenter and the boatman; for the joists of houses and the ribs of sails; the shafts of spears and the wattles of hurdles; the tubes of aqueducts and the handles and ribs of umbrellas and fans. The leaves are sewed upon cords to make rain-cloaks for farmers and boatmen, for sails to boats as well as junks, swept into heaps to form manure, and matted into thatches to cover houses. The bamboo wood is cut into splints and slivers of various sizes to make into baskets and trays of every form and fancy, twisted into cables, plaited into awnings, and woven into mats for the bed and floor, for the sceneries of the theatre, for the roofs of boats, and the casing of goods. The shavings are picked into oakum to be stuffed into mattresses. The bamboo furnishes the bed for sleeping and the couch for reclining, the chair for sitting, the chop-sticks for eating, the pipe for smoking, the flute for entertaining; a curtain to hang before the door, and a broom to sweep around it. The ferule to govern the scholar, the book he studies and the paper he writes upon, all originated from this wonderful grass. The tapering barrels of the organ and the dreadful instrument of the lictor,—one to strike harmony and the other to strike dread; the rule to measure lengths, the cup to gauge quantities, and the bucket to draw water; the bellows to blow the fire and the box to retain the match; the bird-cage and crab-net, the fish-pole, the water-wheel and eave-duct, wheelbarrow and handcart, and a host of other things, are the utilities to which this magnificent grass is converted. I therefore highly recommend this most useful of grasses to your consideration.

The agricultural tools of a Chinese farmer are simple and primitive, being the same as those used for thousands of years past. The plough and the harrow are used for cultivating rice and other grains, while the hoe, spade, shovel and mattocks are used for gardening. The plough is made of wood, the share of which is edged with iron, very flat, and does not penetrate into the ground more than five or six inches. The harrow is a triangular wood frame, interlined with slabs three inches square, with wooden or iron spikes, two or three inches long, sticking out on one side, and the driver stands on the other side while harrowing. The hoe is used for gardening pur-

poses. The edge of the wooden blade is guarded with iron, giving weight and impetus to its blow. The deficiency of tools is made up by patient and hard labor.

The strain put upon the soil to yield so many crops beyond the limits of nature must necessitate the enormous use of manure. Here the Chinese are not at their wit's end. The practice of ages comes to their assistance. Night-soil from all cities and towns is collected into reservoirs; refuse is gathered from the sweepings of houses; poor men and boys may be seen all day long, from the earliest morn, sweeping the streets, paths and fields, gathering the excrements of pigs, dogs, cows and horses. Some make a specialty of collecting offal and bones. A great number are employed in scooping the weeds from the beds of canals, ponds, lakes and rivers, which are put into vats, and covered with mud, to cause them to rot. After oil is pressed from the beans, the bean-cakes are used for manure. The quality and strength of the manure is used according to the requirements of the soil and plant. Rotten fish is also used for this purpose. Almost all kinds of vegetables raised in this country are raised in China.

There is a certain winter vegetable which thrives best when the frost is thick and snow abundant. Fruits, melons and grapes abound. In the northern provinces, watermelons are so abundant that one entering their fields can eat all the melons he wishes, if he will only leave the seeds. These seeds are sent throughout the country in shiploads. Peaches are fine, better than any I have tasted here. The natives cook them in brine, and then parch them on iron pans. In the southern provinces oranges and other tropical fruits are raised, some of which are not known in this country, such as the *liches, lung gans, curambola and pomeloes.* Oranges are often sold on the spot at fifty to seventy cents per bushel. But further north, two to four dollars are paid per bushel.

Rearing of horses is entirely confined to the northern provinces. The horse commonly seen there is more like a Shetland pony. It is bony and strong. The improvement of this noble animal is entirely neglected, and he looks sorry enough compared with the coursers of India or Persia. He is principally used for carrying the post or for military services. Asses and mules are more employed for draught in the north-

eastern province, and camels in Central Asia. In the southern provinces this animal is scarce, owing to the country being cut up with many canals. Sheep are raised in the northern and middle provinces. Their wool is used for making felt, and their meat is much eaten. Cattle are raised throughout the empire. The southern Chinese seldom use (eat) beef on account of religious scruples. They cannot bear to eat the flesh of the animal which had helped the farmer to till the soil to raise grain for the support of man. But the northerners use it freely. There is an animal called the buffalo, very hardy and strong. It resembles the ox, almost hairless; its color is black. It is an animal I would strongly advise you to introduce, not for the delicacy of its flesh, but for its power in tilling the soil and heavy draught. A buffalo has two or three times the strength of a horse, and is more steady. Compared with an ox, I should think the buffalo is the stronger of the two. We can readily see the raising of domestic animals is so much neglected for the want of pastural lands. Grain is too dear to allow acres of land to lie idle for the sake of its grass. The Chinese pig has short legs, round body, sloping back and very short and pug nose. It takes very little to raise them, and pork is the most common meat in the empire. The black Chinese breed, as it is called in England, where it is introduced, is considered the best pork raised in that country. Chickens of the Cochin tribe, and ducks almost as large as geese, are common domestic fowls. The former have been introduced into this country, but I have not seen the duck.

AGRICULTURE FROM A NEW ENGLAND STAND-POINT.

From an Address before the Hampden East Society.

BY H. P. WAKEFIELD.

There is a false notion among farmers, and it is repeated till it is believed by many, that "Farming don't pay in New England." This may be true to some extent, but why is it so? Because of the slipshod, slovenly, and consequently expensive, way in which it is done.

The human frame is so constructed that it must be kept in motion, or it will rust out faster than it will wear out. When man was driven from the Garden, and driven he must be if he disobeyed, under the severe reprimand, "In the sweat of thy brow shalt thou eat bread," it was a blessing in disguise. "Six days shalt thou labor and do all thy work," is a commandment of the decalogue, implying that constant labor is not only a duty but a destiny.

The New England farmer who wrings a meagre but certain sustenance from her rugged soil, envies the inhabitant of more genial climes who resides where physical life can be sustained by the labors of two days in seven, forgetful that his intellectual and moral powers are dwarfed, and that he would blush to tell how he is employed the other five. The golden harvests of the West, raised with little labor and garnered by the improved machinery wrought by the genius of the inventive Yankee, make him discontented with his more restricted products. He sits down, whines and pines over his destiny, believing other occupations more lucrative, and other situations more desirable. But let me tell you, "Every house has its skeleton," and "Each heart knows its own bitterness."

The New England farmers have not been true to their own

instincts. They know that combined force is a power that has not been exerted for the benefit of the craft, but has been controlled by the interest of others instead of its own. There has not been that *esprit de corps* among the fraternity, which, properly exercised, tends to promote its own interests. They have pulled too many chestnuts out of the fire, and others have eaten them while they themselves were blowing on their fingers instead of blowing up those imposing on them. Not that I would inculcate a clannish spirit, but I would have them remember that in unity there is strength, and that no interests are well cared for unless cared for by the parties most in interest.

Again, the great mass of farmers look upon farming as a doomed occupation, instead of the most interesting and elevating in the whole round of employments. It is the man that gives character to the occupation, and not the occupation that gives character to the man. Let a man who has the disposition to invest in farming, money either inherited or acquired by energy in other pursuits, move into a neighborhood, and he is kept at arm's length, regarded as a fancy farmer, instead of being watched for the purpose of learning if peradventure there may not be something in his experiments and practice that may be new to them, and worthy of imitation by all.

Look back on the New England agriculture of fifty years ago, and what a change! Now, although this business at that time stood relatively much higher when compared with other pursuits than at present, farming as a business in New England is now far in advance of what it was at that time. What has contributed to produce this change? Nothing, in my opinion, has done more to bring about this result than this despised class of fancy farmers. And how is this? They have shown by their experiments that improvements can be made, although many of their new-fangled notions result in complete failures. They enter on the business, not for the purpose of making money, but from love of the business, from love of the beautiful, from love of nature, desiring more constantly, more intimately, and more reverently to "look through nature up to nature's God."

The poor farmer has the opportunity brought to his own

door, if he will improve it, to cull and accept the successes, and reject the failures. This costs the farmer of small means nothing except the use of his eyes, his ears and his brain, all of which were given him to use for his own profit. Had it not been for the class of farmers that spend "their money for that which is not bread," many a thrifty, money-getting farmer, who is now spending his money for that which is bread to him, would be plodding along in the old beaten track, cultivating the same fields, raising the same crops, and moving in the same ruts as his grandfathers had done since the landing of the Pilgrims on the ice-bound coast of the right arm of the old Bay State.

Again, many of our farmers have not sympathized with those scientific men who have made great efforts to raise farming to a higher plane, and devoted their energies to the promotion of the best interests of this primeval occupation of man. They cannot seem to realize how such men who do not follow this business for a livelihood can understand the subject, how they can be so disinterested, and do not believe that their teachings are worthy of candid investigation.

These men have so little confidence in their calling, and are so prone to watch for chances outside thereof, that, if placed in the garden of Eden, instead of using "the river which went out of Eden to water the garden," for irrigating purposes, they would divert its waters to run a saw-mill, or make it grind in some prison-house of a manufactory. These men say, they must have some sinister motive, some hobby to ride, and their fallacious teachings will lead their followers away from the good old beaten paths, as the *ignis fatuus* lures the bewildered traveller into morass, over mountain, through forest, marsh and fen, away from his home and family.

A change has taken place in agriculture within the last few decades, and a very great one, too. This no one can deny. And why? What is the cause? What has made the change? Undoubtedly it can be attributed to no one cause solely. But, in my opinion, it is due, more than to any other one thing, to the flood of light shed on the science of farming by those very men, so poorly appreciated by those reaping the greatest benefits from their scientific teachings.

Soils have been analyzed, thus ascertaining what constitu-

ent elements necessary for the production of a given crop were wanting; methods of creating fertilizers have been discovered; ways of saving what were already on hand, but suffered to go to waste, have been pointed out; improvements have been made in tools, and machinery for the cultivation and gathering of the products of the earth has been invented; crops have been increased; better and nearer markets for the disposal of the surplus products have been developed; the products of the soil have been increased in a variety of ways; two blades of grass made to grow instead of one, and the remote cause can be traced to the impulse given to this branch of industry by the men who have given their time, their labor, their powers and their energy to its advancement, not solely for a living, but for the love they bear for the promotion of the science of agriculture.

I am the son of a farmer, bred and reared on a farm, and, by the exertions of an honored sire, who, feeling the want of an education, determined that his son should have a better chance than himself, was enabled to graduate at Amherst; and yet I would to-day give the preference to the junior institution rather than the senior, believing the former can fit a young man to make his way and his mark also, in any profession or pursuit, and at the same time establish in him habits of manual labor, and also give him a knowledge of a business that a large class of persons, especially those who in boyhood have tasted its sweets, wish to engage in, in the declining, if not in the earlier, years of life.

The distinguished clergyman of Adirondack fame, in his address before the New England Agricultural Society, at its late annual meeting, has given us the reasons why young men have deserted the pursuit of agriculture. One is, that it does not pay. Let us look at this matter. Will it not pay in New England as well as anywhere else on the face of the earth, if the farmer here will as readily consent to all the deprivations which those are subject to in less favored portions? If he will be content to live in a hovel or a log-house, with thatch for a covering, and mud for a floor; if he will clothe himself in his own homespun; if he will be satisfied with "hog and hominy" as a universal diet; if he can forego all the pleasures of society, live without the blessings dissem-

inated by churches and the advantages accruing from our New England school-system; if he will withdraw himself from all intercourse with his fellow-man, and draw himself like a tortoise into his own shell; if he can forego all the privileges, all the conveniences, all the luxuries and all the blessings garnered up in a New England agricultural home, looking solely on the almighty dollar as the chief end of man, and the chief aim of his existence, he can have the pleasure, if pleasure it be, to grasp and hug a pile. But what shall it profit a man if he shall gain the whole world and lose all the comforts, all the pleasures, all the blessings, in a word, everything that is worth living for?

"'Tis not the whole of life to live."

One of our distinguished senators from Massachusetts, in his address at the late Worcester County Agricultural Fair, urges that the young farmers of New England, instead of leaving the soil worked by their fathers, invest their profits in adding to their acres, and even run into debt with a fair prospect of liquidating the same from their increased profits.

Nothing anchors a man so surely and so safely as a deed of a spot of land, on which he has erected his domicile, where he has made a home for his loved ones, in which he has garnered all his affections, and around which cluster all his hopes.

These distinguished sons of New England, born on her soil, reared on her farms, find time to give their attention to the science and the practice of agriculture. The one can leave his pulpit, and, going to his farm for vacation, can show that he is just as honorably employed while breeding and training horses and tilling the soil, doing with his might whatever his hand findeth to do in his Master's business, whether in the pulpit, in the stable, or on the turf. The other, amid his onerous duties, when the finances of the nation for four years were managed or ordered by his wise foresight, and at a time also in our financial history that demanded the highest financial ability, could find time to give his attention to his private farm in Groton, and occasionally visit his broad acres, thereby relaxing his overtaxed energies, the better to execute the highest trust ever imposed on a man

in that department since the time of Alexander Hamilton. The example of such men is worthy of imitation. The teachings of such men are worthy of profound study.

I have drawn for you a picture of New England agriculture from my stand-point, sketched a view with my pencil, given you a look through my spectacles, and now with your permission I will close with a few parting words of advice.

A contented mind is a continual feast. What is to hinder the New England farmer from a continual enjoyment of this banquet? He lives in one of the best spots on the earth, pursues the most healthy employment, enjoys the greatest freedom from care, anxiety and peril, is less dependent on his fellows, and more intimately connected with nature in his daily walks, than any other class of men. The true and only way for man to attain true contentment is to school his wants to his natural needs, and restrain the gratification of all others to proper limits, to graduate his desires to the means he possesses to gratify them in a proper manner.

Man's absolute necessities are few and small, but his conveniences are bounded only by his ability to gratify them. The greater share of one's happiness, if he has any worth being called by that name, comes from his home. If that is pleasant in its inmates and its surroundings, it is a constant supply.

Let every man that owns a spot large enough for a domicile, be it a cottage or a palace, see that it is ornamented with flowers, surrounded with shrubbery, decked with whatever tends to enhance the pleasure, and furnished with all the conveniences that tend to lighten the burdens of her who has joined her fortunes with the man of her choice, and whose pleasures are all centered in home.

Let each farmer make it a place that he prefers to the tavern, the store or the gossiping street; a place where he can daily enjoy the smiles of her who left her old home in some country farm-house to fit up a new one, where he can hear and appreciate the prattle of his little ones clustered here, and gambolling in all their sportive innocence, and where, when the labors of the day are done, the whole circle can heartily join in the song, "Be it ever so humble, there's no place like home."

Not that I would restrict man to the gratification of his absolute wants, and counsel him to let his aspirations be satisfied here. He has an intellectual and a moral, as well as a physical, nature to be gratified, and every man is bound to make an effort to do all in his power that these natures also may be cultivated.

Let your aspiration be that the world shall be the better for your having lived in it, that your children shall be better than their fathers, and that progress shall be stamped on your homes, your farms, your stock, your implements and your products. Thus by example will you induce your sons to follow your occupation, instead of drifting away from the old homestead, exposed to temptation and all the fascinating allurements that beset the young man who prematurely slips from the apron-strings of a watchful mother. And your daughter also will practise the economy and industry of her mother, bake, brew, milk and churn, instead of one continuous round of gossiping and novel-reading, as well as cheerfully, in the light of early dawn, practise at the wash-tub, as she can gracefully, after the labors of the day are done, at evening twilight, animate the family circle, or entertain your friends by her skilful touch of the piano.

I want to urge on every farmer to make the effort to be a better one. I care not how good you may have been; you have not reached perfection. There is room for improvement. You have toiled with your muscles, now put more brains into your work. Physical labor is power, but combine it with brains and you increase it a thousand-fold. What distinguished Agassiz from the common laborer, who can only throw mud from a ditch, or sand on a gravel-train? The muscle of the one is better developed, but the brain is dormant, and he can do nothing else, while the other, by his brain-force, stopped little short of infinity. Study your business. A mass of facts lies concealed, and the more you investigate, the more you will be interested. You cannot help being made better agriculturists. By investigation new views will open to you, new phases will be presented, you can better appreciate your vantage-ground, and be more and more convinced that nothing is more honorable than agriculture, and no occupation higher than that of the farmer.

All the products of the soil grow and mature from food deposited there before the germination thereof. This to a certain extent is deposited in growth and decay, but it has a limit. You cannot solve the problem of plant-growth by continual subtraction, to the entire exclusion of addition, but by multiplication of fertili ers you may enjoy a rich division of products. No farmer can cheat his land without being doubly cheated himself. You can draw from the soil only what nature and yourself have imparted to it. If you want large products, furnish ample material, and the plant will not fail to convert it to its use.

A wide-awake, live Yankee may mortgage his farm to extend his acres under favorable circumstances, but it would be wiser to mortgage it for a fertilizer, if he cannot obtain it without, because in this way the value of his land and crop are both doubled. This is not necessary, if you will only save and manufacture all that is within your means. Increase the fertility of your soil by withdrawing deposits from a bank of muck, and depositing the same in your hog-stys, cow-yards and stables. By so doing, you will be enabled ere-long to make investments in Ayrshire, Durham or Jersey stock, which for the farmer is more profitable than any stocks or bonds of gold-bearing coupons, and more safe than any fancy stock which promises that the annual interest shall exceed the principal. The successful business man adds his profits to his capital, and makes larger investments in the same business, in order to make la ger profits. Why will not the farmer go and do likewise?

Many a man who in early life was reared on a farm, after his efforts in business have been crowned with success, returns to some spot enshrined among New England hills, endeared by early associations, where he hopes the birds sing as sweetly and the brooks babble as softly as they did in his spring-time of life, and where he can quietly pass the remainder of his days, and peacefully be laid in his mother-earth, near where were first unfolded to his vision the beauties of a New England landscape.

One word to farmers' boys, and I have done. If there be any young man within the sound of my voice to whom farming is distasteful, who has a penchant for counter-jumping

and measuring tape and ribbons, let him remember that 95 per cent. of those who embark in this business make failures, while in the business of farming over 90 per cent. meet with success.

The pleasure and profit also of a business must be measured by its risks. Few make fortunes at once. Providence wisely orders it thus, for experience shows that fortunes so made are curses, not blessings, in disguise. No one knows the value of money till he has earned some. Let every young man as he toils from day to day, try to realize the blessings and pleasures of a New England farmer's home, around whose hearthstone cluster the sweets of domestic bliss, dearer than any he can find from any other source or in any other place, higher than any his hopes may aspire to, except when he shall have made a similar home his own. To this acme of bliss it is natural and honorable to aspire.

AGRICULTURE AT HOME AND AT THE WEST.

From an Address before the Hoosac Valley Agricultural Society.

BY F. P. BROWN, OF NORTH ADAMS.

I propose to consider first, what for lack of a better title, I shall style the political aspects of farming, namely, its reciprocal relations to and with the State; second, its economical aspects at home as compared with the West; third, to deduce from our premises a line of such practical considerations and suggestions as we may be able, for the encouragement of agriculture at home. And first, the political aspects of farming at home. What has the State done for agriculture? What has agriculture done, what is it still doing for the State? I answer that, aside from the land-tenure, the free titles to our farms, which after all is no small thing, as I propose to show before I sit down, the State has done little or nothing for agriculture; while agriculture has done much for the State. Why, some of our public men have accepted it as a foregone conclusion, that agriculture in New England was inevitably on the decline—a thing to be left out in the cold. We hear much about the glory of manufactures in Massachusetts, and we all believe in manufactures; of "her commerce cleaving every wave,"—and who would strike a spar or furl a sail from the magnificent fleets in our harbors?—of "her institutions of learning various as human knowledge, her institutions of benevolence various as human suffering"; of "the voices of her poets, orators and scholars"; of her history which "the world knows by heart,"—in all these we, too, rejoice. But what statesman in the senate chamber, or poet in glowing verse, has yet celebrated the praises or chanted the triumphs of agriculture in Massachusetts?

Thus far, at home, agriculture has been its own hewer of wood and drawer of water. Into a rocky or sandy soil, in uncongenial weather, it has been turned out to rough it alone. No favoring Mill Acts have given it a roving commission to walk up and down the Commonwealth, seeking only the best privileges. In its circumscribed and narrow limits, it has been compelled to utilize both mountain and valley, barren plain and marshy swamp. Tariffs have interposed no discriminating rates in its favor, nor have the reservoirs of its power been exempt from taxation as in the case of its more favored competitor, manufactures. Yet, farmers of Massachusetts! towns and legislatures cannot tax the sunshine and the dews that ripen your crops, nor can they levy a subsidy on the free breezes of heaven that fan the rust from your wheat-fields and give health and ruddy cheeks to your children. Nor can you be shut out from the indirect benefits of this commercial and manufacturing prosperity. A good market is the first requisite to remunerative farming, and that, at least, the whirl of these spindles and the click of these pegging-machines secure to you in inexhaustible measures for all time. Nor would it be any disparagement to Massachusetts, if she were styled an exclusively manufacturing or commercial State. The country is great because of its diversities no less than because of its unities. It is well that States cannot exactly repeat themselves. Acknowledging all these diversities, glorying in these multiform and never-conflicting interests and resources of our country at large, glorying also and rejoicing in the wonderful prosperity and development of manufacturing interests in this Commonwealth, and especially in this valley and township for the past decade, conceding the superiority of the West as a grain-producing empire, I yet disown and disclaim any christening of my adopted State, or any classification of its interests, that shall leave out and unrecognized the occupation, the harvest and the home of the farmer! Why, just think of it my friends. If manufactures and commercial pursuits in our State have made all the noise, and attracted most of the attention at home and abroad for the past few years, agriculture has kept her steady equilibrium and advance from the beginning. If, during the past decade, the productive resources of Massa-

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chusetts have increased seventy per cent., as the statistics show, while some of our manufacturing cities and towns have doubled in wealth and population, those same statistics abundantly demonstrate that our agriculture has not been idle, but has made liberal contributions to bring about this magnificent aggregate result.

What has agriculture not done for the State as the pioneer of all its industries? It was the farmer who first took the axe in hand and went forth into the wilderness to make it "blossom like the rose." From the nature of his calling he must ever lead the van in the upbuilding of states and empires. And the toil that subdues a wilderness and sweeps the mountain-side clean for the harvest-field, carries also in its train the click of the anvil and hammer, the hum of factory voices, the screech of the steam-whistle and the songs of school children. Look again. The farmer is no niggard. He upbuilds the State's enterprises. From his broad forests he selects the material that feeds your saw-mills and constructs your cities. From his soil he gladly eliminates the clay that moulds the brick for your factories, the limestone and sand for the mortar that lays them. From his choicest flocks he supplies the fleeces for your woollen mills. His cattle furnish beef for your markets and hides for your tanneries. He utilizes the chemistry of sunshine and soil to supply vegetables for your city hotels. While, most noticeable of all, in view of recent pretentious and asserted superior claims o railroads as related to farming interests, the farmer makes even those corporations his debtors, not only by furnishing them his products for transportation, but, by bonding the farming towns through which they pass, he even lays his broad acres under perpetual tribute for their construction and successful operation.

Again, agriculture has benefited the State as a school of patriotism. I need not in this connection cite the traditional and hackneyed examples, the historical celebrities suspected at some period of their lives to have had a weakness for agriculture.

And then the dignity and stability which agriculture confers upon a State. Think of the farmer's inheritance. Not content with investing him with dominion over the earth's

surface, his title-deed grants him rent free, earth, air and sky, "corporeal and incorporeal hereditaments," from the zenith to the nadir! Besides it is so ething to own an integra part of the State. How well our adopted citizens, the Irish, understand this, when they set us the good example of investing all their spare cash and accumulated earnings in a homestead and a little land, believing that here, as in the old country, to be landless is to be a vagabond, while to be a land-owner is to be a king, or, what is be ter in the eyes of Pat, it makes a politician of him.

But look a moment at the other side of the question. If the Commonwealth is indebted to agriculture as the pioneer of all its industries, the school of patriotism and defender of home, the State, by the genius of her institutions, by the prestige of her glorious banner of liberty and untrammelled thought, has well-nigh ca celled the indebtedness and rendered the farming interests, not only of Massachusetts, but of the country and the world, er wards and debtors for all time. I refer to the free-land tenure that is conferred by her charter, to the system of small farms and independent laborers that the Commonwealth has recognized and fostered from its very inception at Plymouth Rock. These conditions are as essential to the growth and development of an agricultural community, as are sunshine and air to the growth of plants.

I turn now to the question of profit and loss; to the economic aspects of agriculture at home as compared with the West. We have thus far dwelt ma nly on agriculture at home, to its reciprocal relations with the State; its struggles, drawbacks and triumphs; its contributions to patriotism and the State's industries; to the dignity which the Commonwealth has in turn conferred upon i by investing it with the robes and regalia of liberty. T e next question is, Does farming in Massachusetts pay? Is i as remunerative as at the West? Statistics answer this question better t an I can answer it. Take, for example, Ohio, Wisco sin and Illinois,—three of the most favored of he Western Sta es in soil, climate and population,—and compare their annual productions with those of Massachuse ts. If we take the census re urns of 1870 for our guide, we shall find that, excepting the three cereals, corn, wheat and oats, Massachusetts produces more,

according to her territorial extent, of all other agricultural products, than either of the three States mentioned; while even of these cereals we raise as much in quantity, and far more in value, according to the acreage actually sown and planted. Take the items of hay and potatoes as representative products of weightier and bulkier class. In 1870—

Massachusetts produced of hay, . .	507,000 tons.
Ohio " " . .	1,923,000 "
Illinois " " . .	1,895,000 "
Wisconsin " " . .	1,223,000 "
Massachusetts produced of potatoes, .	2,208,000 bush.
Ohio " " .	8,282,000 "
Illinois " " .	8,427,000 "
Wisconsin " " .	4,585,000 "

Taking into account the difference of areas of these States,—that of Massachusetts being only 7,800 square miles, while that of Ohio is 39,964, Illinois 55,410, Wisconsin 53,924 square miles, it will be seen that, of the two products, hay and potatoes, Massachusetts produces approximately twice as much per acre as either Ohio or Illinois, and three times that of Wisconsin. Take as further illustration the item of tobacco, which our neighbors of the Connecticut Valley are cultivating to a considerable extent. We raise 6,289,000 pounds per annum, or about one-eighth more than the entire State of Illinois, with an area seven times our own, one-third as much as Ohio, with an area five times that of our own, six times that of the entire State of Wisconsin, and only one-third less per acre than the famed tobacco State of Virginia, while the value per pound in Massachusetts is double or triple that of Virginia.

Shall we, then, go West to engage in agriculture, on account of the greater productiveness of the soil? Wait till your prairie-lands and new Territories have withstood the drain of even one generation's crop-raising without making adequate returns to the soil in the shape of fertilizers, before you pronounce them so immeasurably superior to the soil and crops of New England, both of which, after a fashion, have withstood the test of two centuries, and are yet far

from rebelling against our wants, if only the soil has decent treatment in return. Once more. Look at the capacity of Massachusetts for stock-raising. In 1870 our total valuation for live-stock was $28,250,141. Ohio had relatively about the same number to the square mile. Wisconsin had less than one-third the valuation to the square mile. While Illinois, with its mammoth dairies and extensive horse-power, has an average valuation of live-stock per acre in relation to ours, as six to seven, or sixteen per cent. in favor of Massachusetts. Nor does the greater relative population in Massachusetts destroy the force of these comparisons, since the surplus population of Massachusetts is engaged in other than agricultural or stock-growing pursuits. Nor do our mechanics or factory employés, as a rule, keep horses. On the contrary, our greater population, taken into account with the question of transportation, renders the force of these statistics immeasurably stronger in our favor, since the percentage of values of our crops and agricultural products is increased over that of their mere quantity, by the cost of transportation and the enhanced prices created by the demands of a constant market.

But our winters are cold, and the glories of our autumn landscapes do not compensate the farmer for the untimely touch of frost on his melon-patch or waving corn.

What then! Shall we go to Michigan to escape frost, where the fever and ague is a summer and autumn pastime? Or to Minnesota and Arizona to get rid of cold winters, where the records of the past winter show that trains were blockaded for weeks by impenetrable snow-drifts, where the thermometers all froze up, and men durst not be profane lest their oaths should congeal on their lips? Shall we go South to cultivate sugar-cane in Louisiana, or cotton in the Carolinas? Yet experience proves that emigration to be successful must not disregard isothermal lines and parallels, and that a climate perhaps excellently well adapted to invalids would be enervating and enfeebling to the hardier vigor and nerve trained in a New England climate.

Then there is the question of transportation—just now the all-absorbing topic at the West. Into this vexed question I claim no prophetic insight. Nor does it materially concern

our subject, except as demonstrating the vast superiority of the New England and the seaboard States over the great West in reference to location as to the home markets and the markets of the world. But it would be unworthy the New England name and character were we to pride ourselves upon our accidental advantages of location, and plead exemption from service and sympathy in this great struggle. Rather it is the cause of labor against monopoly the world over; of farmers and farmers' productions everywhere against the grasping exactions and combinations of railroad rings and scheming stock-jobbers and speculators, a contest in which our instincts and sympathies alike ally us with our brothers of the West. While we insist, with patriotic ardor, that New England must never be left out in the cold politically, we are equally strenuous that the States and Territories of the vast West must not permanently be left out in the cold as to agricultural and commercial interests and advantages. It is a contest from which there can be but one issue, and, unless we greatly misjudge the signs of the times, the railroad kings,—the Vanderbilts, Drews and Tom Scotts,—may as well learn to meet the people half way in their demands, or they will wake up some fine morning and find themselves Samsons shorn of their locks. Monopolists and stock-gamblers, be they demigods in wealth, who feast upon the necessities and wants of the people, must stand aside, for the farmers of the West, whose name is legion, are literally on their tracks, and they don't propose to burn corn for fuel another year in Missouri or Kansas, because freights are so high they cannot transport it to the seaboard.

Farmers of Massachusetts! you have yet to reap and to enjoy your advantages. Do you say your territory is too circumscribed and limited? Look at France for an example. With a territory less than one-sixteenth of that of the United States, and but little greater than that of the two States of Massachusetts and California, she raises fifty per cent. more wheat than our whole entire country; supports a population within two millions of our own, and exports more value in butter alone to England than our country does in breadstuffs. Why, her imports and exports are nearly double our own, according to the statistics of our agricultural bureau

at Washington, while in her vineyards, as in the fineness of her woven textures, she beats the world. Shame on us, boasting, liberty-loving Americans, thus to be compelled to take lessons from the old worn-out empires of Europe. Yet the quicker we learn that we are yet infants in the science of agriculture, and in the development of our resources, the better will be the future of farming and industrial pursuits. The time has gone by when the farmer is expected to be everything at once,—a stock-raiser, a pomologist, a horticulturist, a dealer in thoroughbreds, a dairy-man, a wheat-grower, a cultivator of potatoes and tobacco, a reclaimer of swamps, a landscape-gardener, and a pettifogger of his own lawsuits to boot; yet all these he was expected to be in the New England farming-days of the past. All this has gone by. Thoroughness should be the motto of the hour. Breadth of acres will not save us. Twenty acres to the farm supplies the Frenchman, and yet the farmers of Massachusetts average one hundred acres. If you wish for the advice of a layman, here it is: Pursue specialties; concentrate your forces; double up the old farm in value as you bisect and trisect it in quantity; keep your boys at home and give each a slice of the old homestead. Thank God, we have no law of primogeniture in Massachusetts, whatever may have been our practice. Teach one of your sons to be a breeder of thoroughbreds, another to be a pomologist and vine-dresser, a third—if the list extends so far—to be a horticulturist and raiser of carrots. Teach them this: that whatever they do must be done thoroughly, and to put the plough to the beam. Keep up the dignity of your profession by reading the best newspapers and scientific works on your calling, cultivate the social amenities, and "take your wives often to the fair."

Above all, be not too impatient of results. Not in a day—not in a day—like Minerva, full-orbed from the brow of Jove, is the farmer's inheritance brought forth from the sky and the soil. His wealth is coined by the slow yet sure march of the seasons, the patient handwork and brainwork of years. Yet remember, that if his calling has made no such brilliant, such magnificent advances and strides in the old Commonwealth as has manufactures for the last two or three decades, it has at least been spared the humiliation of the dark

days of panic and disaster like those of '37, '47 and '57, which almost drove our commerce from the seas, and silenced the voices of these spindles in our mills. Remember that the farmer's corn grows while he sleeps, that his bankers are the inexhaustible treasuries of the earth, air and sky and his own industries; and that, if true to himself, to the interests of the Commonwealth and the command of God, he has in the future but to vindicate and adorn the title, already awarded him, of "earth's and nature's nobleman!" Thus, as the seasons roll round, shall his vineyards and his orchards bend with luxuriant fruitage to the praises of Pomona. "Thus shall the earth bring forth her increase," and "the cattle upon a thousand hills rejoice," as the farmer returns in autumn "bringing his sheaves with him!" Thus shall our agriculture at home, as we trust also in the West, the queen of empire, hand in hand with other useful arts and industries, march on, winning bloodless victories, reaping golden harvests. Manufactures shall not be ashamed to own her as a rival and an ally in the march of civilization. White-winged commerce shall gladly receive her commodities to distribute inland or to bear them across the sea. Education and science shall welcome her as the elder sister of the household, having left off at last her garments of drudgery, and donned their own star-gemmed robes as for a feast-day, while liberty, patriotism and religion, shall still cling to her as giving stability to our institutions, firmness to our national character, and virtue to our people, without which we cry in vain, "God save the Commonwealth of Massachusetts!"

FARMERS' HOMES: WHAT THEY WERE, ARE, AND OUGHT TO BE.

From an Address before the Housatonic Agricultural Society.

BY ALEXANDER HYDE.

Our first suggestion for the improvement of farmers' homes is, that more thought be bestowed upon the site. Convenience for work and shelter from cold winds would seem to be the only considerations with some farmers in choosing a site for their home. It may be very convenient, so far as work is concerned, to be located near the centre of the farm, and to be able to step from the front door into the street and from the back door into the barn-yard, but such is not a site for the home. It is not the retired, quiet, comfortable place that we associate with home. Work is man's heritage and blessing, but God never designed this world to be merely one great workhouse. Refinement and beauty are as manifestly the design of the Creator as is utility, and he who would build aright, must imitate the great Architect, and combine considerations of health and comfort with those of labor and profit. The house should be located, not only at a suitable distance from the dust and noise of the highway, but also from the filth and effluvia of the barn and pigpen. The house is not made for the barn, but the barn for the house, and the wind should circulate freely and largely between the two. We have known a corner of a barn finished off for the residence of the farmer, but nothing short of necessity should compel a man to shelter his family under the same roof with his dumb beasts. It has been said that a farmer can be known by his barn. There is truth in this; but whoever puts the barn first and house second has more farmer than man about him, and

will probably plan and labor more persistently for the thrift of his stock than the comfort of his household. A green, well-shaved lawn in front of the farm-house, where the children can romp and play, and the wife can cultivate a few flowers, is one of the rights on which every woman should insist.

Another suggestion as to the site of the farm-house is, that it should be on some elevation, above the fogs and miasms of the valley, and commanding a pleasant, if not extensive lookout. We have seen so many prairie farm-houses squatted in the mud that we have learned to prize the high and dry sites which are scattered so profusely through New England, and we have often wondered that, with such a site on almost every farm, so many houses are built in low, damp, unhealthy situations. The reason probably is, that the owners have the impression that the elevated site must be bleak and cold. The winds may indeed strike the house on the hill with some force, but as for the cold, it is always colder in the valley, of a still night, than on the hill. Corn is frost-b tten later in the spring and earlier in the fall in the Housatonic Valley, than on the elevated and dry sites which overlook it. We say dry sites, for not every elevation is f ee from the damp, chilling and unhealthy influences which emanate from marshes. We find cold muck-swamps as frequently on the hills as in the valley, and in their neighborhood we may look for early frosts and malarial fevers.

Another suggestion is, that every farm-house be built where the sun shines for the most hours of each day, and the most days of each year. There is life in sunshine, and he is not wise who places his house where the sun does not rise till late in the morning, and sets early in the evening, or where, during the whole day, it is rendered dark and dismal by dense foliage. Trees have their uses, but it was never the design of Providence that man should live in a forest. Even the wild beasts, who make their home there, contrive to take a frequent sun-bath. On the sheltered, sunny side of some ledge of rocks, or on the southern slope of some hill where the rays of the sun fall most perpendicularly, there the forest-born beasts most do congregate. The nimble squirrel climbs to the sunlight on the limb of some tree, and there takes his

sun-bath, apparently asleep, but the hunter always finds him dozing with one eye open, and he is very apt to slip into the shade when he hears the click of the gun. Even the mud-turtle, that is commonly supposed to love darkness rather than light, is found basking on some log or rock, each sunny day. The same love of sunshine is manifested by all the inferior animals. Why should man, endowed with reason, be less wise than the beast, with only instinct for his guide?

We would by no means convey the idea that the home should have no trees to shelter the location from the summer's heat and the winter's cold. We would plant trees for both these purposes, but in this cold climate, more for the latter than the former. If a house is situated on a bleak hill it may be sheltered from the prevailing winds by a belt of white pines or other evergreens, planted on the windward side, which, even in winter, will give it a cosy, comfortable look, and really add much to the warmth of the location. A few stately elms, with here and there a maple or an oak, and scattered clusters of evergreens placed in front and on either flank, will give to the home a retired, sheltered look, such as the word originally signified; but they should never be planted so as to shut out the sunlight from any room in the house. From May to November there is nothing in the externals of a rural home so pleasing to the eye as a green, velvety lawn, and this we cannot have with an overhanging forest. But at all events let the sun strike fairly upon the house, and from the living-rooms let no blinds intercept the rays. In light there is color, energy and life; in dark there is pallor, lassitude and death. The houses of our city cousins are so sandwiched between each other that light can only be admitted from the two ends, and we are sorry to add that they generally prefer darkness to light, and keep their blinds closed and curtains drawn, lest the sun should fade their carpets, or color their cheeks. Let city children grow pale and feeble in the "dim, religious light" in which they are brought up, but country lads and lasses have a birthright to more light and life.

The house should be built with two or more stories. Why our fathers built so many low, squat-looking houses, with hot, dark, ill-ventilated and inconvenient chambers, has ever been a mystery to us. Probably it was done, partly from motives

of economy, and partly from ignorance. It costs, however, but a little more to build with two stories. The same shingles that cover one story will cover two, and the increased accommodations will pay fourfold for the increased expense. We once asked a farmer who was building a one-story house with a cellar-kitchen under it, why he did not put on another story and arrange his kitchen where it ought to be, on the first floor? His reply was, "The nearer you can get your work to the earth the more convenient it is. I don't like climbing up into chambers." "But will not your wife find it inconvenient to be running up and down the cellar-stairs?" "Yes, possibly, but women were made for work, and the cellar-kitchen is very handy." The dismal, damp cellar may have been very handy for work, but we noticed that the wife did not live very long to work in it, and with the advent of a second wife the cellar-kitchen was converted into a potato-bin.

If our family consisted of only two persons we would build the house with two stories, and would sleep in a chamber on the sunny side. "Climbing up into chambers" may be a little inconvenient for old folks, but when they are once there, the dryer, purer air will compensate for the labor. The nearer the earth the more convenient it may be for *sleep* as well as work, but we should not, on this account, either work or sleep in a cellar. The more remote from the ground the chamber, the better is the air, especially in the night, and good sleeping-air is one of the essentials for health and long life.

A story and a half house is but little better than the old-fashioned one-storied. It has a fourpence-halfpenny look. The chambers are low and warm, and the little windows under the eaves furnish poor light, and still poorer lookout. A house with twelve-feet posts may be considered economy by some; we call it parsimony. Sixteen-feet posts cost but little more, and furnish far more comfort and health.

Analogous to this parsimony in the height of the house, is that of putting a cellar only under a part. We rejoice that this old practice is pretty much obsolete. Cellar-room is always wanted, even though we may not stow away so much cider in it as formerly. The expense of a whole cellar is but little more than that of a half cellar, as the walls must be built on two sides in both cases, and when built of the same

size as the house they furnish a stable foundation. Half-cellared houses are very apt to be lop-sided.

One word as to the ventilation of cellars and farm-houses. Farmers generally utilize cellar-room for the storage of potatoes, turnips, and other root-crops. It would be more for the health of the family if these were stored in the barn-cellar. They are wont to decay more or less before spring, and in their decay they emit the seeds of disease and death. Decay propagates decay, as surely as life propagates life. How the decomposition of vegetable matter should produce decomposition in animals is a little mysterious, but there is no doubt about the fact, and probably more typhoid fever has originated from putridity in cellars than from the decomposition of vegetable matter in some neighboring swamp. The malarial atmosphere from the swamp is greatly diluted with pure air before it reaches the house, and is inhaled in homœopathic doses, but that from the cellar, unless conducted off artificially, permeates the whole dwelling. We have been in some houses where the odor of rotten cabbages and turnips was so perceptible that we felt we were inhaling poison.

If farmers must stow their roots in the cellars of their houses, they should at least provide some way of escape for the noxious gases there generated. Fortunately this is easily done, if the chimney extends, as it always should, to the cellar-bottom. No ventilating-tube was ever invented equal to a chimney, and no better deodorizers can be found than smoke, soot and creosote. If a register be placed in the chimney near the top of the cellar, the foul air will escape through it, instead of finding vent through the doors and cracks into all parts of the house. Similar registers should connect the kitchen. and indeed every room of the house, with the chimneys. The problem of thorough ventilation can be solved in no other way, so simply, so cheaply, and so effectually. If there is a sink, or cesspool, or water-closet, that is breeding miasm and death, the simple remedy is to connect it, by means of a pipe or tube, with the chimney. The current of poisonous gas will, in every case, be found rushing up this tube, and the smoke and soot of the chimney will effectually destroy all its contaminating influences.

Finally, let the farm-house be built and furnished simply.

We do not look for elegance and display in the homes of yeomen, but we do expect and ought to find neatness, refinement and comfort. Simplicity is not incompatible with good taste, in fact it is the highest evidence of it. The true gentleman is simple in his manners, simple in his dress, in his equipage, his house, furniture, style of living and in all his fixings. It is the upstarts, the Jim Fisks, the suddenly rich, who want to make a dash. We expect no such snobbery from the tillers of the soil, who earn an honest livelihood by patient toil. The farmer, however, is entitled to a comfortable home, and his house should be commodious and tasteful, without being ostentatious and expensive. We have many such in this county, and we would like to mention some of them as model homes, but this would make an invidious distinction.

With all outward and inward appliances for a comfortable home, we must ever remember that home is where the heart is. A shanty, with love in it, is better than a palace filled with envy and strife. We have spoken of our earthly home as a type of our final and blessed abode, but as love is the secret of the joy of heaven, so is it the mainspring of the exquisite delights to be found in the circle that surrounds the family board. Not every farmer that builds a spacious and convenient house for his family, succeeds in making that family comfortable. Together with the building of his house he must build himself on the solid foundation of all manly virtues, and together with the culture of his farm he must cultivate all kindly affections. Nor should these affections be confined to those of his own household, but extend to his neighbors, and to the whole brotherhood of man. The farmer's home should not only be the trysting-place for children, grandchildren and relatives, but the seat of refined and generous hospitality. God has made us social beings, and he only enjoys home in its fullest extent, who there ministers, not only to the wants of his family, but entertains his friends cordially and liberally. In thus laboring for a comfortable home and cultivating all family and social affections, and ever cherishing gratitude to the Giver of all good, we may confidently expect that our homes will foreshadow the perfect bliss of heaven.

PROGRESS IN TWENTY-FIVE YEARS.

From an Address before the Norfolk Agricultural Society.

BY ROBERT MORRIS COPELAND.

When we say twenty-five years, it seems but a small time; but when we say a quarter of a century, it seems a long time; and it happens to-day that we have reached one of those distinguishing boundaries in our progress, which mark an important step gained,—that we have passed one of the heats in which this society has made good time. It has got now far beyond the hopes of those who founded it. If those gentlemen could have foreseen even but a part of what has been accomplished, they would have been amply satisfied. One looks now at the society and the county with a good deal of honest pride. Look at the county compared with what it was twenty-five years ago. We have, indeed, the same landscape and the same natural beauties of the earth as before, yet in those days the farms crept up to the very feet of Boston. Where boys who are now men gathered nuts and stole apples, are now to be seen solid streets of stores and manufactories. You find that in Dedham and Canton and Hyde Park and neighboring towns, the requirements for building and manufacturing have raised the land in value far beyond its worth for farming purposes. Go back a few miles to the land that was so poor that it was once considered to be worthless, and there now you will find Hyde Park, which has grown up to be a handsome rural city. We see what has been done during the past twenty-five years; what will be done during the next twenty-five?

We talk of the progress which the world at large has made, and oftentimes overlook what has been going on

around our own homes. We all understand and appreciate what has been done in the business and manufacturing interests; yet in the domain of agriculture there have been improvements, which are greater in the aggregate than all that have been accomplished in other fields of effort, and yet we find that they pass almost unnoticed. Twenty-five years ago an ordinary cow, of the native breed, brought only about $25, and perhaps an extraordinary animal might have cost $75. How little did the people of those days imagine that a cow would ever bring the enormous price which one was sold for the other day, for the sum of $40,600! Such a thing, even now, will almost take away one's breath. Such things as these have taught the most reluctant men among the farmers the worth of improved breeds of stock and of scientific farming. Years ago they would not believe that foreign cattle could ever become acclimated in this country, or secure the high prices which they cost, but this thing has been done. The American farmer went to Europe and bought some of the best animals, and see what they have done for the whole land! Where is the farmer now-a-days who is not pleased to see a little of the yellow blood of the Alderney under the hair of his cow, or to have an animal he happens to own compared to the Jersey? We find animals now bringing prices which in those old days seemed fabulous. It is a very little time, also, since a horse sold in this country has brought as high a price as $1,000. People said it was all very well for those who could afford it to raise fine horses; but they were luxuries and subserved no useful end. But what would they say of this great improvement in cattle? A gentleman once went to Europe and bought a merino sheep, at great expense, and brought it to America. The people said it was a foolish outlay of money; that it couldn't be acclimated, etc.; but an animal of this same breed, raised in America, has since been sent back again to its native land in Silesia, and even carried away the highest prize for excellence in that country. We have also made a vast improvement in agriculture. Look at the increased number of fruits that your past president, Mr. Wilder, has shown here, compared with what he could have shown twenty-five years ago. See the fruits that have come out of the old Walker nursery; they have

made an impression throughout the country, way down in Delaware and Pennsylvania. We in New England actually live on the mother soil of the world. When we go out to the farms in the West, we are apt to think that that is the only place for the farmer; but the fact is, fully as much can be done in New England by mechanical and scientific processes, and by using all the means which are placed in the hands of the farmer here. These old pudding-stone rocks of New England, for instance, give you all the lime and the manurial requirements wanted, and with the common air you can get all the culture you need. I had occasion to go down to Delaware a few months ago,—a State where men get $5,000 for an acre of strawberries. I saw one corn-field upon which the man told me he had raised eighty bushels to the acre; but I told him that in New England they sometimes raised one hundred bushels to the acre, not including the pumpkins, squashes, etc., which were raised with it. I mentioned that one hundred and seventeen bushels of corn had been raised to the acre in the town of Pembroke, Mass. This story was very hard for the man to believe.

But it is not these exceptional crops, let me say, that are best calculated to improve our agriculture; and this leads me to the subject upon which I want especially to speak to you, viz.:—"What really should be the objects and the motives of the agriculturists of this country?" We are all talking about the science of agriculture. What we want to know is whether it can be reduced to practical results. These various experiments, made by men to get extraordinary crops, do but little to advance the real science of agriculture. True science gets all the facts, lumps them together, and deducts conclusions from the whole, and not from isolated parts. The agricultural colleges do a vast deal of good, and will do more when the people come to understand what the real value of an agricultural college is. They teach that it is better to offer a premium for crops which can be easily raised, than for those extraordinary crops which can only be raised with difficulty. It is well for the farmer to understand the limitations of his work, and to know what he can do and what he cannot do,—what ought to be done and what ought not. Crops are like human beings, to a certain extent. They have a stom-

ach, and require certain kinds of food. If you treat a crop with special manures, you can soon find by experiment just what that crop likes, and precisely what ought to be done for it to get the best results. You all understand, after a while, the importance of reducing the bulk of manures as much as possible. Let me refer again to Delaware. The soil of that State is made up of the washings of a great river. A large portion of the land has been cropped and cropped, until some of it will now hardly bear sorrel, it is so poor. A man went down there some years ago and bought some of this land that would not pay taxes. He cultivated it with only superphosphate of lime, with a view to raising crops of peaches and strawberries. It was like taking a drowned man out of the sea. By means of the proper manuring, he soon restored this land to a state of fertility and raised most excellent crops. The rules of wealth and the laws of nature combine to teach the lesson which may be applied right here amongst you. All summer long, Boston has been complaining of the bad odors from this river and that river. Worcester has been complaining of her sewage; so have Newport and other places. We find that the Back Bay of Boston is the source of a good deal of trouble—that the people living in the large houses of that section say it is unhealthy. These matters may seem about as far off from agriculture as the North Pole, yet they tell us some stern facts of nature. You make huge draughts on the guano-banks for material to put on the land, and yet you waste in your rivers and sewers manure worth more than guano. Not only this, but the effluvia from great sewers poisons the air and undermines the health of the people. And yet you allow the waste of matter, which, if fully utilized, would make Norfolk County the garden of the world; you throw away, in fact, what would make this county and every other county fruitful, and you die and pay for it. We shut our eyes to all this, yet they will in time have to be opened, and opened, perhaps, in the sternest way. In giving your premiums, also, you should look more to what will develop the general agricultural interests of the county, rather than simply the development of special crops. On this question we must deal with things in the mass.

There is another side to the question—its æsthetic side. I

have only to look about me to see that you appreciate the beauty of flowers. Within a few years past the farmers have developed many out-door plants which it would have been thought impossible to raise twenty-five years ago, except in greenhouses. We find flowers everywhere, for nature loves beauty. We ought to do everything which will tend to encourage the people to appreciate the beautiful, and in floriculture many can find a most congenial as well as profitable vocation. It is only a very short time since, that when people talked about beautifying a country place, men turned aside with a sneer and asked, "What is it all worth?" The worth of beauty, let me reply, no man can tell. The birds and flowers and many other objects of nature which we see around us, have beauty developed in a most extraordinary degree in color and form, and all these things teach us that what is worth doing at all is worth doing well. You have, to be sure, your public parks and streets planted with trees, but how little in the way of natural adornment has been done as yet, and how much has been left undone!

Let me now go back once more to the old agricultural question. It is hardly possible for us to realize the improvements which are in store for us during the next quarter century. If agriculture has grown to such great proportions during the last twenty-five years, and horticulture has become what it has, then it is reasonable to suppose that many wonderful improvements are still in store for us. When we see the farmers right around us with their horse-rakes and other modern appliances, we are apt to think that about all has been done that can be done; that we have about reached the limits of agricultural machinery; but this is not so. One ingenious man has made a machine, which, I believe, is destined to thoroughly revolutionize agriculture—to make as vast an improvement as is seen in improving the breeds of cows from the old grade of $20 to the modern-blooded animal of $40,000. Those who have seen the Wilkinson steam-plough, to which I refer,—an engine with a wheel like the foot of an elephant; which can carry ten wagons loaded with men, and will accomplish a vast amount of work in a very short time,—will understand the worth of this new agency. I have seen this machine hitched up and running ten ploughs. It

will save from ten dollars to fifty dollars to the farmer every time it is used. Thus you will see, my friends, that agricultural science is as yet but in its infancy. The farmer who now tills twenty acres will in the future till one hundred acres, and do it with greater ease and profit than he can now manage his twenty. These monster machines, to be sure, are too expensive for any one individual to own, but a score or more farmers, by clubbing together, can make it profitable to use them. When you realize the vast possibilities of the future, you will believe that the man who is with us to-day—who has seen such improvements as Colonel Wilder has seen during the past twenty-five years—will be but as a mere child in comparison with the grown man of a generation or two hence.

FOREIGN AGRICULTURAL EXPERIENCES.

ESSEX.

From an Essay, by FRANCIS H. APPLETON.

Having attended the show of the Yorkshire Agricultural Society, of England, and the show of the Highland and Agricultural Society, of Scotland, I want to give some information about what I saw at them. I was only a part of a day at the former, but was three days at the latter. The former is the society's show of the largest county in England, and the latter, while it is the leading agricultural society of Scotland, is also a worthy rival of the Royal Agricultural Society of England.

I left London one morning, and reached Harrowgate, in Yorkshire, the same afternoon, it being the fourth of August. The following morning the show opened at nine o'clock, and I was at the entrance early, where I found the fee equal to about seventy cents. The following day the fee was about twenty-eight cents. The first day at English shows is generally the time that the judging takes place, so that, in order to avoid a large crowd of people which would impede the judging, the fee is then placed at a higher figure than afterwards. It is their object, also, to have the prizes all awarded and every prize-animal and article distinctly labelled as soon as possible after the entrance-gates are opened to the public. At some English shows that I attended, the judging was completed before the public was admitted.

The judges are carefully selected men, and everything that is placed on exhibition is subject to the societies' laws and regulations, which are strictly enforced. These laws and regulations have been carefully compiled and revised, and, as they at present exist, are the result of many years of practical application and experience.

To no country can we so well turn for instruction in the management of our agricultural societies as to our mother country, Old England. I did not meet with a case where a committee of judges was composed of more than three persons, and they often consist of only two members.

No entries can be made with the secretary of a society after a fixed day, at least several weeks before the show takes place, thus allowing the necessary provision to be properly made for the exhibitors, the positions on the grounds to be definitely assigned beforehand, and a complete catalogue of every animal and article exhibited to be printed, containing a plan of the grounds, showing the exact position of the various classes. These catalogues are for sale during the exhibitions, and as soon as all the prizes have been awarded, a list of these also is printed and sold. The former sold for about twenty-six cents, and the latter for half that amount.

By the methods adopted in England and Scotland, the prizes are so carefully awarded that inferior and unworthy animals, etc., very seldom, if ever, find their way into the prize-lists.

The officers of the societies personally superintended the carrying out of all the arrangements upon the show-ground, assisted in expediting the duties of the judges by preventing delays in bringing animals into the rings and in other ways, saw that the prize-cards were properly attached to the animals, had order enforced when such was necessary, and made themselves generally useful in whatever ways were possible.

Suitable offices were provided upon the grounds for the government of the societies, judges and reporters. A refreshment-room was also there under the patronage of the society, but was in no way financially connected with the society.

Yorkshire being a part of England where many hunters are bred, this class of horses formed a large part of the exhibition, and a magnificent lot of animals they were. A large ring, about two hundred and eighty feet long by one hundred and thirty feet wide, with rounded corners, was used for judging them, and there was also a similar ring with a swinging hurdle in its centre for testing their leaping pow-

ers. There was also a third ring, for judging cattle, about one hundred and fifty feet long by one hundred feet wide. Each of these rings had two swinging gates at either end, one having "Entrance" and the other "Exit" over it, in white letters on a black ground. The former was conspicuous only from outside the rings, and the latter was readily seen from the inside. All chances of confusion were thus very much lessened. In the centre of the judging rings were seats for the judges, and a signal-board, upon either side of which were posted the number of the class, as shown in the catalogues, and the numbers of the animals receiving the prizes; the numbers were changed as each class left the ring.

Each animal carried a white cardboard label, bearing its catalogue number in black lettering, which was tied between the horns of cattle and on the breast of the horses, as a means of ready reference to the catalogue, where full descriptions of all entries were given. The prizes are awarded and the ribbons attached to the animals by the judges before they are sent from the rings.

On the last day of the Yorkshire show, which lasted three days, there was a parade of the Shorthorns, at 10, A. M.; and at 10.30, a parade of all the horses, in the largest ring, in front of the grand stand. The several rings were inclosed by a wooden fence, formed by driving three-inch by four-inch joist into the ground, about eight feet apart, leaving about four feet out of the ground, then nailing a similar piece of joist along their tops. The cattle were in open sheds, twenty feet wide and of the required length, divided in the centre by a partition, which reached to their top and extended their whole length, and on either side of this partition, stalls, ten feet square, were formed with boarded sides, about four and one-half feet high, to hold one animal. These sheds were covered with canvas, as were all the other buildings, except a few of the largest.

One cattle-ring was sufficient, as, it being the home-county of the Shorthorns, the other breeds were represented by a very small number of animals. In the same way among horses, the hunters so largely predominated that one ring sufficed.

At the entrance several self-registering turnstiles were placed, and each visitor was notified, by a conspicuous sign, to enter through one or the other stile according to the kind of ticket that he possessed. This, besides being a precaution against dishonesty, was also the means of readily recording the number of visitors at the show.

The agricultural implements, road-engines and other portable steam-engines, were the only articles not under cover, and even some of these were provided with shelter; all live-stock and other articles were in covered sheds. At the Yorkshire show a number of closed boxes were provided for horses, and also a row of boxes with open fronts. All the horse-boxes and sheds were here arranged with the fence inclosing the grounds for one side.

Let me now speak of the Highland and Agricultural Society's show, more particularly in those respects wherein it differs from the Yorkshire. Much of what I have already said will also apply to the former.

All horses, except brood-mares with foal by their side, were shown in stalls arranged with the heads towards the high fence which inclosed the show-grounds, and with a passage about eight feet wide behind the animals, under the same cover; this was a close shed, and the fact that there were two hundred and ninety-seven horses entered for exhibition will give an idea of the length of shed required. The boxes for the brood-mares were arranged in the line of stalls, and were about the width of two stalls and length of one, the fronts being formed with movable wooden rails to the height of four and one-half feet. Every day, except the first, there was a parade of all the horses in the morning and also in the afternoon, commencing respectively at 12 and 2.30 o'clock; but the cattle were never paraded. This may seem to many of my home readers a hard thing to accomplish satisfactorily, knowing the number of horses exhibited, but each class being paraded separately, though in quick succession, and volunteers being ready to lead the horses when necessary, who seemed to be stimulated to do so by their interest for the success of the show, every horse was always present in the line looking his best.

The prize-winners took the lead in their proper order of

merit and were distinguished by different colored ribbons, every animal having his catalogue number attached to him in a conspicuous place. This constituted the chief feature of interest to the mass of the people, and took place in the large ring in front of the grand stand, where an extra fee of about twenty-six cents was charged for entrance.

Everything was arranged on the grounds according to their classes, and every class was arranged according to the order in which the entries were made with the secretary. Thus full justice could be done in the criticisms of visitors, and the judges, knowing this fact, and feeling that their reputation was thus at stake, were necessarily most careful in making their awards of prizes.

A military band played well-selected music at fixed hours during the shows. To make an average statement, it may be said that the grounds were opened to the public at 8.30 A. M., and closed at 6 P. M.

The complete catalogue of the Yorkshire society contained about one hundred pages, with some additional pages, the use of which was sold for advertisements. It also contained a good plan of the show-grounds, and the programme for the show. It was a pamphlet measuring five and three-eighths inches by eight and one-half inches. The Highland and Agricultural Society had one catalogue for live-stock, containing one hundred and four pages, and another for other entries, of seventy-two pages, each with no advertisements. Both of these were the same size as the Yorkshire catalogue, and all had good indexes.

The total number of live-stock entries in the Highland and Agricultural Society were: Cattle—Shorthorns, 83; Polled Angus and Aberdeen, 68; Galloway, 40; Ayrshire, 126; Highland, 47; fat stock, 38; extra cattle, 4; total, 406. Horses—for agricultural purposes, 221; hunters and roadsters, 40; ponies, 27; extra horses, 9; total, 297. Sheep—Cheviot, 67; Black-faced, 55; Border Leicester, 67; long-woolled, other than Leicester and Border Leicester, 35; Leicester, 15; Southdown, 9; Shropshire, 20; short-woolled, other than Southdown and Shropshire, 3; extra sections, 4; extra sheep, 3; total, 278. Swine (divided into two classes only, large and small breeds), about an equal number in each class, 61; extra swine,

1; total, 62. Poultry, 387. Summary, by heads: cattle, 406; horses, 297; sheep, 582; swine, 96; poultry, 534; total, 1,915.

The total number of entries, by heads, in the Yorkshire Agricultural Society were: Cattle, 106. Sheep—Leicester, 78; Lincoln, 64; Shropshire, 33; total sheep, 175. Pigs, twelve months old and upwards, large breed, 7; small breed, 10; black or Berkshire breed, 7; breeds not qualified to compete in previous classes, to be judged in one class, 17; pigs, not exceeding twelve months old, large breed, 11; small breed, 19; black or Berkshire breed, 11; pen of three store-pigs of any breed from four to nine months old, 15; total pigs, 97. Horses, 335. Blacksmiths (competition for prizes), 23. Total entries of live-stock, as in catalogue, 736.

I feel that we can take many a good suggestion from the facts I have given, and I hope my fellow-countrymen and others will peruse them and compare them with our needs at home.

The English societies have no located grounds, but have always found it best to move from place to place each year. Their grounds are fitted up by contract, and the boarding is sold after the close of the exhibitions. The Smithfield Club Fat Cattle Show in London is one of the very few that are located. This, however, cannot be compared with our agricultural society shows. In English shows exhibitors have every opportunity given by which all the useful powers of the animals exhibited for the societies' premiums can be displayed and judged.

In order to give a good idea of the encouragements offered for the breeding of both beef and milch cattle in Great Britain, I give the following summary of prizes, etc., offered by the Yorkshire Society for Shorthorns, representing beef-cattle, and by the Highland and Agricultural Society for Ayrshires, representing milch-cattle:—Shorthorns, class I., bulls, any age above three years old, best, $140; second, $55; third, $27; 9 animals entered, but 6 exhibited. Class II., bulls above two and not exceeding three years old, best, $112; second, $55; third, $27; 5 entered, but 3 exhibited. Class III., bulls above one and not exceeding two years old, best, $112; second, $55; third, $27; 11 entered, but 9 exhibited.

Class IV., bull-calves above five and not exceeding twelve months old, best, $82; second, $55; third, $27; 16 entered, but 11 exhibited. Class V., cows of any age above three years old, in calf or milk, best, $140; second, $55; third, $27; 8 entered, but 4 exhibited. Class VI., heifers not exceeding three years old, in calf or milk, best, $112; second, $55; third $27; 13 entered, but 8 exhibited. Class VII., heifers not exceeding two years old, best, $112; second, $55; third, $27; 11 entered, but 6 exhibited. Class VIII., heifer-calves, above five and not exceeding twelve months old, best, $82; second, $55; third, $27; 14 entered, but 13 exhibited. Total amount of premiums, $1,548; total animals entered, 87, and total exhibited, 60. White rosettes attached to animals indicated first prize; crimson, second; and blue, third.

Ayrshires—First prize, bulls at former shows—each animal exhibited in this class receives a medium gold medal; 2 entered and 2 exhibited. Class I., bulls calved before first of January, 1871 (this list was compiled for the show of August, 1873), premiums, $112, $55, medium and minor silver medals (making four premiums); breeder of best bull, silver medal; 9 entered and 9 exhibited. Class II., bulls calved after first of January, 1871, premiums, $112, $55, medium and minor silver medals; 16 entered, but 13 exhibited. Class III., bulls calved after first of January, 1872, premiums, $55, $27, medium and minor silver medals; 18 entered, but 15 exhibited. Class IV., cows in milk, of any age (the animals in this class which have not calved before the show will be judged along with cows, in calf, of any age), premiums, $82, $44, medium and minor silver medals; 31 entered, but 20 exhibited. First prize cows at former shows: each animal exhibited in this class receives a medium gold medal; 3 entered and 3 exhibited. Class V., cows in calf, of any age, or heifers in calf, calved before first of January, 1871 (animals in this class which have calved before the show will be judged along with cows in milk), premiums, $82, $44, medium and minor silver medals; 14 entered, but 12 exhibited. Class VI., heifers calved after first of January, 1871 (animals in this class which have calved before the show will be judged along with cows in milk), premiums, $55, $27, medium and minor silver medals; 18 entered, but 15 exhibited. Class VII., heifers calved after first of

January, 1872, premiums, $44, $22, medium and minor silver medals; 16 entered, but 15 exhibited. Total amount of premiums, $816, medium gold, 7 medium silver, 7 minor silver and 1 silver medals; total animals entered, 126, and total exhibited, 103.

To show the encouragement offered for the breeding of agricultural (which includes draught-horses in general), and also coach horses, I give the following. But my readers must remember that in Great Britain the hunting-horse being used for purposes of exercise and pleasure, while in this and other States the trotting-horses are by far the most generally used for purposes of pleasure, I cannot well make a comparison by giving a copy of the premiums offered for hunters in Great Britain. The premiums offered by the Highland and Agricultural Society of Scotland for agricultural horses are:—

First prize stallions at former shows—each animal exhibited in this class receives a medium gold medal; 2 entered and 2 exhibited. Class I., stallions foaled before first of January, 1870 (this list was compiled for the show of August, 1873), premiums, $165, $82, medium and minor silver medals; breeder of best stallion, silver medal; 24 entered, but 19 exhibited. Class II., entire colts foaled after first of January, 1870, premiums, $110, $55, medium and minor silver medals; 36 entered but 27 exhibited. Class III., entire colts foaled after first of January, 1871, premiums, $82, $44, medium and minor silver medals; 41 entered, but 33 exhibited. Class IV., entire colts foaled after first of January, 1872, premiums, $55, $27, medium and minor silver medals; 22 entered, but 18 exhibited. Class V., mares (with foal at foot), foaled before first January, 1870, premiums $110, $55, medium and minor silver medals; 19 entered, but 15 exhibited. First prize mares at former shows, exhibited for medium gold medal; 1 entered and 1 exhibited. Class VI., mares (in foal) foaled before first of January, 1870, premiums, $82, $44, medium and minor silver medals; 15 entered, but 8 exhibited. Class VII., fillies foaled after first of January, 1870, premiums, $55, $27, medium and minor silver medals; 12 entered, but 9 exhibited. Class VIII., fillies foaled after first of January, 1871, premiums, $44, $18, medium and minor silver medals; 21 entered, but 17 exhibited. Class IX., fillies foaled after first of January, 1872, premiums,

$33, $16, medium and minor silver medals; 19 entered, but 12 exhibited. Class X., draught geldings foaled after first of January, 1870, premiums, medium gold, silver, medium and minor silver medals; 5 entered and 5 exhibited. Class XI., draught geldings foaled after first of January, 1871, premiums, medium gold, silver, medium and minor silver medals; 4 entered, but three exhibited. Total amount of premiums, $1,048, medium gold, 1 silver, 11 medium silver and 11 minor silver medals; total animals entered, 221, and total exhibited, 169.

The premiums offered by the Yorkshire Agricultural Society for coach horses are: Class I., coaching stallions, $55, $27; 10 entered, but 9 exhibited. Class II., two-year-old geldings, $55, $27; 8 entered and 8 exhibited. Class III., two-year-old fillies, $38, $16; 4 entered, but 3 exhibited. Class IV., three-year-old geldings, $82, $27; 12 entered, but 11 exhibited. Class V., three-year-old fillies, $55, $27; 4 entered and 4 exhibited. Total amount of premiums, $327; total animals entered, 28, and total exhibited, 26.

While making a short but most interesting visit to a Hungarian acquaintance, I was shown, among other things, a way of curing fodder-corn that I know must be new to most of my readers, and wishing to make it known to them I had intended to write of it now. My Hungarian friend has, however, adopted my suggestion and has himself written a description of it for the "American Agriculturist," which I copy. The fodder is cut for use in a manner similar to that in which hay is cut from a stack.

"SOUR-FODDER MAKING.—The curing of various kinds of green fodder into sour hay is perhaps in the United States a not commonly practised manipulation, especially the souring of green corn, which should be practised with more effect on the farms of the United States of America. The making of dry hay of green is an injurious manner of curing it. Although the writer of this is not acquainted with American farming, except by reading the 'American Agriculturist,' nevertheless I communicate a method of preservation of juicy fodder, peculiarly important for corn-producing America.

"The corn is sown broadcast, or drilled in rows nine to eighteen inches apart, two mezins to one Austrian toch (or about 3.3 hectolitre to one hectare). [This is nearly three

and one-half bushels to the acre.] The cultivation remains the same; the field must be kept free from weeds. At blossom-time the corn is mown, loaded into wagons, and hauled in. The home-brought corn is put in large ditches (German, Grube Miethe), ten or twenty rods long, and is here pressed in by a few men walking on the green corn. The ditch is twelve feet deep, twelve feet wide at the top, and six feet at the bottom. The length will need to be sufficient to contain the fodder to be preserved. The ditch must be dug in dry ground. When the ditch is filled, the green corn is built like a stack upwards, about ten feet over the level of the ground. The finished stack is then covered with earth about two feet thick on every side. It is best to cover the top of the stack at first, because the weight of the earth pressing down the green corn, as much earth is not needed for covering as is the case when the sides are covered at first.

"This sour-hay making enables us to store a large quantity of juicy fodder for the winter, and if well covered with earth it may be stored for a few years without any injury. The most important of all is, the beasts being once acquainted with this sour hay like it very much. With us (in Hungary) the sour hay is cut and mixed with corn-meal, or some other ground grain, and given to the cattle, but the sour hay may be fed uncut also.

"In sections where stones and bricks are to be obtained, chiefly the sides of the ditch may be walled, but it is not necessary.

"I should be very glad if these lines would serve to encourage the sour-hay making of corn by the American farmers."
—*American Agriculturist for October, 1873.* G. C.

ALBRCHTSFELD, HUNGARY.

HINTS AND SUGGESTIONS ON MANAGING THE FARM.

ESSEX.

An Essay by CHARLES J. PEABODY.

How can a young man with a small farm and but little money make more than it costs to live? A difficult question to answer, as not only have the situation and soil of the farm to be considered, but the disposition of the owner also.

I purpose at this time to discuss what can be done by farmers having from fifty to eighty acres of good land, in the central or western part of the county. A fair valuation of such land in my neighborhood is $40 per acre for pasture-land, and $75 to $125 for fielding, and I suppose about the same in other sections of the county.

To this discussion I come with but a limited experience; and though I have given much thought to the subject, as every one must to his constant employment, the conclusions to which I have come are doubtless somewhat imperfect, as time enough has not elapsed to thoroughly test them in the field. And many men have found that if all that can be done on paper could be made equally satisfactory and profitable on the farm, we should not need to pursue the subject of this essay any further, since by availing ourselves of a few books we could all be wealthy and wise.

I have no plan to offer which is original with myself, for I believe the best chance of success is found in looking into the methods of those who have been prosperous, and copying the best points of their systems into our practice.

In doing this care must be used that the changes attempted are not on so large a scale as to embarrass one, if any unexpected circumstances should prevent its being as profitable as was expected. This is especially true of new crops, as fre-

quently the experience of several summers is needed to enable one to grow them at a profit.

The great difficulty in our farming operations is the scarcity of good help. I put it on the basis of *scarcity*, not *cost*, of labor, as is frequently done; for I think the relative wages of farm laborers to-day are no higher, when compared with the prices of farm produce, than they were when good men received fifteen dollars per month for the season of six or eight months, and extra help could be had in haying for half the present price. A partial remedy for this is found in the use of horse labor for many operations which were once done by hand. Nor is the use of the horse confined to the hay-field, but every year it is found that some new work can be done as well by horse as by man power.

For instance, many men who raise large crops of potatoes cover them with a light plough drawn by a single horse, thus doing the work rapidly and well. I find that even on heavy land this method works well, if a little care is taken to go over the ground and level the top of the furrow, where lumps of earth or stones rest upon it.

It will be seen that if a change of this kind can be made, and this branch of work quickly disposed of, attention can be given to other work and thus a start obtained on the season's work, that will be appreciated as the weeks pass. Another point on which opinion is changing is in regard to the amount of land it is best to plant; the old custom of many acres and medium crops is giving way to the system of Europe, and conforming to the practice of the gardeners near our cities, which is to put on to one acre all the manure and labor the old way gave to four, and getting a crop equal to the larger lot.

The old story of the man who left his sons a treasure buried in a field, which they were to find by digging, will apply to Essex County as well as elsewhere. Some recent writer has said that most men reckon only the superficial area of their farms, as if they had a title to but a few inches in depth, forgetting that often a soil may be made much more productive by cultivating below the level at which it has usually been worked.

The author of "My Summer in a Garden" says he derived great pleasure in thinking that though he had but a small piece

of land on the surface of the earth, yet he owned clear through to China. Even if we do not care to go in quite so deep as he did, we may with advantage work deeper than many of us have been in the habit of doing.

I find that so fully are some of our best nursery-men convinced of benefit resulting from deep culture, that they take pains to trench the soil of the beds in which they grow their sample plants and shrubs to a depth of two feet, claiming that the extra expense of cultivating the ground is more than repaid by the increased vigor of the plants, The experience of our onion-growers points in the same direction, as they find that the more thoroughly the soil is prepared the more profitable is the crop: and the best results are not obtained till years of careful culture have been given to a field.

It may now be considered as proved that one acre well worked is more profitable, as well as more enjoyable, than two half cared for; therefore let us strive in friendly rivalry to see who shall have, not the *most* acres, but the *best*. Here is another consideration in favor of small farms, the taxes are less, and while we may double the value of our land by high farming, we do not have to pay for it as we should if we increased the number of acres.

From the cultivation of the soil we pass easily to the consideration of the team with which we cultivate. Whether for this, oxen or horses are best, must depend largely on the character of the soil, and also to what use the animals can be put when not at work on the farm. For my own use I prefer oxen, because, although slow compared with horses, they are sure and much less expensive both in first cost and also in maintenance, while if disabled by accident the loss is slight, as they are of value for beef, to what the loss of a horse is under similar circumstances. They are also more easily obtained when an extra team is wanted for a short time, and may often be fattened and sold at a good profit when the work is done, while horses are hard to dispose of as well as to obtain.

Many persons would be surprised at an attempt to educate oxen beyond the point of making them understand the meaning of the words employed to direct their movements. I have satisfied myself that they can learn much more than this, and that time spent in training a yoke of oxen that one intends to

keep for a length of time is well employed, as the intelligent labor of an animal, as of a man, gives the best results.

In view of the advantages resulting in many instances from underdraining, it is well for us to inquire if we may not with profit do something by this process to make the wet lands of our farms more productive. If we have not the capital to make extensive and thorough work with tiles, most of us can make a beginning with the small stones that have accumulated during past years; for these will make a good drain if laid with care.

There are those who say that on springy land it will pay to drain the whole farm. I think, however, it is not proved as yet, that for common farming the return would exceed the outlay. We are, however, likely to learn from the experiments of the gentlemen who, with ample resources, combined with a love for farming, are working out for us in Ipswich, Hamilton and West Peabody, not to mention other places in the county, so many valuable results in this matter of draining, and also in the application of commercial fertilizers and home-made composts, giving us from year to year the conclusions and the data from which they are drawn, thus aiding us, who are *unable* to enter the field of costly expenditure, to determine what will pay. It is a common custom to sneer at the fancy farming of such men. I think we are under obligation to them for the introduction of fine stock, new crops and the experiments to which I have referred.

How much of interest is added to our annual shows by the choice animals of these wealthy farmers. Even if we do not care or cannot afford to own such ourselves, yet we enjoy looking at them and judging of their adaptability to our use by the record they make.

As an illustration of the benefit conferred by this class of farmers in past years upon their neighbors of more limited means, I would cite the introduction of Jersey stock. Nearly every one admits that for dairy purposes they are unequalled, and I find that a grade Jersey will sell for more money than a common cow. It is also much in their favor that for common use, with ordinary care and keeping, the grades are better than the thoroughbreds.

For this improvement in our stock we are indebted to *fancy*

farmers. Who else would have incurred the expense of importing cattle, and on their arrival offered such facilities for the diffusion of the blood among the herds of their vicinity?

We will now endeavor to suggest some characteristics of the man who will be likely to prosper in his business, as they are shown in the records of old time and set forth in the writings of those who, from their position, are always listened to with regard; and endeavor to combine these with such facts as I have been able to gather from the men who are good farmers around me, and from my own experience.

I find the difficulty we experience in Essex County to-day of getting active men to work for us is not new, and the principle that to be fit to rule farms or cattle men must be smart, is as old as the time of Pharaoh, who said to Joseph, "If thou knowest any men of *activity* among thy brethren make them rulers over my cattle." The garden of the slothful man, with the condition of its crops, is also on record somewhat further along in the same book. I think this activity, to give the best results, should be continued through the winter, by doing some outside work, such as teaming wood or timber, or almost any job that offers employment and pay for time that cannot be well used at home.

This should not be pushed to an extreme, for to be wise in the development of one's powers some time in the winter must be spent with books and with friends, or else the usefulness of the man will be little more extensive than the area of his farm.

Another point to be regarded is the value of time in the busy seasons of the year. We will find that work drives if the spring is late, and hoeing and haying come together; when this happens, we must make the best of it and make every hour tell on the work. Something may be done in preparation for the season of hurry by having tools in order, all farm machinery made ready in advance, so that when the rush comes on we can start the mower without spending hours in getting it into running order. In furtherance of this design, it will pay to keep all small tools in particular places, and after using them put them where they belong.

A little care expended at night in looking over the tools used during the day, in cleaning ploughs, and hanging up chains

and harness, so that in the morning (which according to the proverb has gold in its mouth) no time shall be lost, is the best way, I have found, to keep things square, "with the work right up to the season's front" from day to day.

There yet remains a subject which, if not so important in a pecuniary aspect as some we have considered, is still quite as likely to affect the farmer's reputation among those who are not particularly familiar with farming as any we have discussed. I refer to keeping the premises, and particularly the door-yard, neat and trim. On most farms there is no necessity for having a brush-pile in front of the house, nor all the old carts and sleds assembled as if they were the chief attraction of the homestead. Such things we see more often than is to the credit of our fraternity. If we must clutter, let us keep it out of sight as much as possible, for both strangers and thrifty farmers will mark us down in the scale if we are negligent in this regard.

In closing this article, if I was asked to write down the secret of profitable farming, I should like to call your attention to the sentiment expressed by Steele, in a letter to the "Spectator," under date of Jan. 23, 1712, which is as follows: —"He who promises himself anything but what may naturally arise from his own property or labor, and goes beyond the desire of possessing above two parts in three even of that, lays up for himself an increasing heap of afflictions and disappointments." How significant these words to-day, in this panic of those who make haste to be rich by speculation and fraud.

Since to our labor we look, we must be active, must know that time is precious, and learn to be quick, for there are so many duties to attend to, that, with all the machinery of modern farming, we shall fail to realize the benefit of the statement that "much increase is by the strength of the ox," unless we apply that executive ability to all departments of our work, which has ever characterized those whose success has made them famous in any of the industrial pursuits of the world.

The counsel which Dickens puts into the mouth of one of his wise old men, who is advising a nephew about to start in life, is worthy the careful study of all young men. He says: "The world is before you; as you enter it so will it receive you; if you had the abilities of all the great men past and

present, you could do nothing well without sincerely meaning it and setting about it. If you entertain the supposition that any real success in great things or in small ever *was* or could be, *ever* will or can be wrested from fortune by fits and starts, leave that wrong idea here."

The man who wants a leisure life had better keep out of farming in all its branches; but the man who believes "that his own right arm shall make him king," not king over men in the sense in which the words were written, but king over difficulties and obstacles in his path; the man who knows something of the feeling of the Scotch poet who "walked in glory and in joy behind his plough along the mountain side"; the man who has the skill and patience to make two blades of grass grow where one grew before; to him we say, "All hail." Welcome the day when by the efforts of such men the care of our farms shall be considered as honorable and as worthy the best efforts of the best men as the care of banks or the affairs of commerce.

SOME THOUGHTS ON THE MANAGEMENT OF AGRICULTURAL SOCIETIES.

MIDDLESEX SOUTH.

Prize Essay by Rev. J. H. TEMPLE, of Framingham.

The agricultural society has passed the stage of novelty and experiment, and become a well-established and well-defined institution. It has a history of its own; its special province is understood, its capabilities have been tested, its defects ascertained.

Like all voluntary associations, it is subject to alternate seasons of depression and prosperity. It has the usual obstacles to overcome; and is not exempt from the common causes of internal friction.

In the working of the democratic principle, selfishness has its fullest scope. Men become adepts in the use of influences which, indirectly as well as directly, promote personal aggrandizement. They accept place with great apparent disinterestedness, but with the settled purpose to make it pay. They claim that the public shall remember their voluntary services, whenever the said public bestows its suffrages.

Strange—and yet not so strange, after all. The agricultural society offers a place where the man of lazy leisure and political aspirations can advance his own interests. Its more permanent offices bring the occupant into close relations with the bustling as well as the more retired class of farmers, and by a judicious distribution of circulars and reports, and some wisdom in making up committees, he lays down a little wine for use in the possible contingency of his candidacy for public favor. Naturally a little clique is formed and becomes self-perpetuating. And just as naturally outsiders are disgusted, and distrust and disappointment create conflicting

interests, and *the society suffers.* Its best supporters are alienated. The impression is abroad that four out of five of our larger county societies are just now afflicted with this fatal "ring" consumption.

The plain way to prevent or cure such an evil is to put in office busy, capable men, who are in full sympathy with the agricultural interest, and who have to be persuaded by urgent duty to accept the place and who will under no circumstances consent to be candidates for more than three years in succession.

And this brings out an important element in the successful management of our agricultural society, viz.: *frequent rotation in office.* There may be some loss of valuable experience; but there is a gain of popular sympathy and support, which more than counterbalances. If the efficient coöperation of an efficient man is to be secured, he must have his share and his turn in the direction of affairs. Where time and thought and anxiety constitute in large part the capital invested, he does not care to put these in the exclusive control of others; he wants his share of the responsibility and the authority. And if these are monopolized by a few, the sympathy and help of the many is forfeited. The man of purpose and resource and energy goes where he is appreciated. And though the man of action and force of character is not always the man of wisdom, yet he keeps things moving; he prevents the wheels from sinking into the deep-worn ruts.

It is a truism—but it needs to be often repeated,—*the management of our agricultural societies should be in the hands of agriculturists.*

And the corollary truism is that *the annual fair* of such societies should be *the exponent of the great middling interest,* —the farming and the farmers, where land and labor is the capital, and the products of industry are the means of support. The gathered results of the season's culture and growth should represent work rather than wealth; should show the possibilities of skill and toil rather than money.

The great need of the middling class is a stimulant for inquiry and enterprise. The average farmer works hours enough, and puts forth strength enough, and wears out fast enough; but he does not plan wisely enough and have sys-

tem enough. He does not make every blow tell. He does not make enough of experience. He does not think enough and compare results and learn from his failures as well as his successes. He needs a demonstration which forces upon his mind wise conclusions, and at the same time is an impulse to action, which shall lift him out of the ruts that bind his load.

Just here the value of his weekly agricultural paper, and the "Farmer's Club," is seen. But he is tired at evening when he reads the paper, and the discussions of the Club perplex him, because no two speakers agree about either means or ends.

The annual fair of his agricultural society exactly meets his case. It brings together *tangible results*. It shows what men, situated just like himself, have accomplished under the same favorable or unfavorable circumstances as his own. There is set before him *food for thought;* a standard of comparison; a test of methods; the proof of what skill and care and persistent effort have accomplished.

But if the pens are all filled with blood-stock, beyond his means to purchase, and the tables are covered with fruits from the greenhouse and borders of the professed gardener, and vegetables which were raised by the extra labor and extra manuring which ready cash can command, he is not stimulated and encouraged. He is interested, but not helped. He sees the result of money, not of work. He feels that what attracts most notice and receives all the premiums is beyond his reach. His ambition is dampened rather than quickened.

The blood-stock has its place in our agricultural fairs as its owner has his place in our agricultural societies. Nothing has given a greater impulse to improved methods of farming and the general prosperity of our rural communities than the coming in of men of taste and fortune. By the introduction of labor-saving implements and varied and continual experiments in the use of fertilizers and rotation of crops, and the testing of new theories, and trial of different breeds and systems of breeding, and by a hearty and noble liberality, these men have become a most welcome adjunct and helpful means to the farming interest. And no fair would be complete without their thoroughbreds and the results of their

refined taste and abundant resources. This class of land-owners and land-cultivators are our main dependence for advance in scientific agriculture. They are to lead the way to better systems and true prosperity.

But, under existing circumstances, the advanced farmer is not a representative, nor is scientific farming the exponent.

The average farmer's capital is his land and labor. And the problem he has to solve is, how his labor on his land is to feed and clothe and educate his family; how, without extras, he can secure the best paying crops and dairy products.

The practical question, then, is, How shall an agricultural fair be managed so as to bring out the best products secured by these two classes of cultivators, and at the same time give due prominence to the results of average farming? How shall we encourage the man of means to exhibit his best specimens of stock, and samples of breeding, and of fruit and grain culture, and not discourage the man of labor?

On the present system of appointing committees, the small farmer knows beforehand that he stands no chance in competition with his advanced neighbor. He may be conscious of *skill to use his limited means*, so as to make large per cent. gains, so as to show a handsome net profit. His experience in the use of simple labor-saving implements, or a carefully digested system, or a judicious use of inexpensive fertilizers, may be of special value to the young man who is beginning with only a pair of willing, strong hands, and a frugal, helpful wife. But he has little inducement to bring forward the results of his labor and experience. He may make a paying crop of corn or potatoes; but it is not *an extra crop*—neither extraordinary in size nor amount; and the overgrown roots, and the forced growths, and the exceptional yields, are certain to take all the premiums.

The annual fair is always the test of a society's real prosperity, as well as its most direct means of usefulness. And to enlist the sympathy and bring out the great body of farmers, with their families and farm produce, is a consideration of prime importance.

Some of the things to be done to secure this end are obvious.

1. Committees should be chosen for their fitness, not for their availability.

2. The classification of products and stock should be such as to give just prominence to all worthy and wisely directed efforts at improvement.

3. Premiums should be awarded for samples of the best in quality, rather than the greatest in quantity.

4. The conditions of a premium should be, minimum of time and labor with maximum of skill, rather than extraordinary results from extra means.

The exhibitor should be required to give brief details of *facts* and omit the *figures*, which are commonly deceptive; should show with clearness how he obtained his good result, and let the committee and the spectators foot up the cost and cash profit. As a common rule, the cash footings of the required "Statements," only represent the ingenuity of the exhibitor in using small figures on the Dr. side and large figures on the Cr. side. Facts are less elastic than figures.

If one man can raise from one-half bushel of seed, with ordinary manuring and ordinary cultivation, twenty-five bushels of potatoes of marketable size (of which he offers samples in both a raw and cooked state), and another, with extra manuring and extra time, can raise thirty bushels from the same quantity of seed, of overgrown tubers, it does not follow that the latter is deserving of the premium. The skill and the net profit and real excellence may all be with the smaller yield.

So of the dairy. One feeds on roots and stimulating grains, and secures a large flow of milk; but it is *a forced result*, unnatural, and debilitating to the cow. Another feeds on grass, green or dry, with nourishing grains, and gets a good yield of rich milk, but less in quantity than the first.

The smaller amount contains most cream in proportion to bulk, and yields a better quality of butter; and the cow thus treated continues hardy and productive to old age. Taking a series of years, the greater net profit may be with the smaller amount. And so a distinction should be made between a natural and a forced result.

The same line of reasoning applies to the exhibition of live-stock. The best result to be attained by ordinary care and

skill, with ordinary means, should be encouraged. Because an imported animal costs $1,000, which his owner is well able to pay, this does not form *prima facie* evidence of desert of the first premium, although it may have all the accepted points. An animal costing one-fourth of that sum may have an equal practical value; may net a larger profit on cost, and, of consequence, have a superior claim to consideration.

There are, of course, difficulties in the way of equalizing things so diverse and complicated. But once get the great body of intelligent agriculturists together, each with samples of his best skill; let the tables groan under their weight of autumnal bounties, and the pens be crowded with specimens of stock which has intrinsic worth and comeliness; let a common interest and purpose actuate all, and the *esprit de corps* be awakened, and the apparent difficulties will vanish. A generous, honest rivalry is quick to break through technicalities. If every farmer and gardener connected with any one of our societies would bring to the fair the best product of his summer's work,—and every farmer gets every year something which he knows to be excellent of its kind,—the aggregate would surprise and gratify all. Each would be proud of his own contribution, and proud of the aggregate. Such a fair would need no extra attraction.

With such a collection of products and facts before him—largely the result of ordinary culture—the young farmer finds encouragement. *It means, him.* He feels that he can do all this; he will compare his methods with his fortunate neighbor; he will determine to excel his fortunate neighbor; he takes a step in the path of progress and improvement. And when the spirit of inquiry is awakened, and the hope of better things inspired within him, his success is assured.

To repeat: The main dependence for success in the management of our societies and fairs is, *agriculture and its proper adjuncts.* The legitimate results of wisely applied industry is what uplifts and refines and benefits the masses.

These legitimate results of wisely applied industry are not restricted and common-place and unattractive. They are valuable enough to command attention; various enough to awaken interest; curious enough to allure; beautiful enough to please; complicated enough to make people think; and sub-

stantial enough to satisfy. No intelligent man or woman or child ever tires of examining the summer's beauties, or the autumn's bounties,—ever ceases to admire the wonderful results of culture, or to love the works of taste and skill.

Neither the fragrance of the lily and rose, nor the fair proportions and skilful arrangement of the ripened corn, nor the ruddy or golden or white colors and strange forms of edible roots, nor the tempting sweetness and aroma of delicious grapes and pears, ever palls or cloys. And the unsolved mystery will interest our children as it does us, how such beauty and purity and perfection can come forth from the unseemly ground.

The introduction of extraneous means to create temporary excitement, and draw a crowd, is, to say the least, a questionable expedient. If it succeed for the time, it is at the sacrifice of some vital element, and a re-action is sure to follow.

The men and women of simple habits and refined tastes and limited knowledge of the world, find the desired recreation and amusement in the fair itself, in the endless variety of vegetables, and the tastefully arranged fruits and flowers, and the handiwork of art, and the meeting with old friends. They want the kind of recreation which rests the tired body, and the excitement which is a healthful mental tonic. The folly of climbing a greased pole, or the ridiculousness of a sack-race, or the perils of a balloon ascension, or the artistic slaughtering and dressing of the fat ox, or the immersion of a dog in confined gas to see it die and revive again —do not satisfy the spectator, leave no pleasant impressions, add nothing to the store of valuable knowledge, lighten no burdens, and cast no sunshine on to-morrow's toil. He laughs or cries, as the case may be, for the moment; and the next moment is ashamed of himself for yielding to the transient emotion.

The attempt has been made by many of our agricultural societies to make the trotting track a leading feature of the annual fair. But it is believed that in most instances it has proved a failure. As a novelty, it drew the crowd; but when the novelty of the thing was past, it kept away as many as it attracted. And it keeps away those who ought to be there; whose coöperation gives strength and stability.

The truth is, the race-course is not in any true sense, the ally of agriculture. It is a thing by itself. It has its own laws and its own inspiration and its own associations. It is offering a high premium for a *forced result;* not for any quality of work that is natural to the horse. Neither the owner nor the trainer nor the spectator nor the horse gains anything useful by the trial of speed and endurance. The care and training of the animal for the trot against time are all extras—outside of any call of duty. They are what no farmer, as such, has an interest in. His $200 horse, which is trained to the plough and harrow and cart, and can take his family to church at a ten-minute gait, is all he needs; is worth more to him than the $2,000 trotter, which can make his mile inside of 2.40. He may find his curiosity gratified by the fast time; he may see cause to admire more the noble animal which has ever been man's most efficient ally; but he cannot shake off the conviction that it is a forced result.

A track, where the action and natural speed and strength of the horse are exhibited, and the best methods of control and training are shown, has a value, and adds interest to our fairs. But there can be no doubt that the conviction is growing among our thoughtful people, that the race-course is an excrescence that should be cut off.

CULTIVATION OF THE PEAR.

MIDDLESEX SOUTH.

Prize Essay by Mr. ABEL F. STEVENS, of Natick.

The culture of the pear has long been of peculiar interest. The great excellence of the fruit and its nearly continuous season of perfection — some late-keeping varieties nearly meeting the earliest-ripening sorts—and its great beauty as a tree, have always maintained its culture as one of the most refined. Although it is one of the most anciently cultivated trees,—as we learn from history that it was known to the Greeks and Romans more than two thousand years ago, and today it is grown in all the temperate climes,—yet its fruit is still scarce in all our markets, compared with other fruits; the finest varieties are seldom seen, so that really fine pears are but little known among the general public. Its value as a domestic fruit is second only to that of the apple. It is one of the most luscious esculents, and as a table-fruit is indispensable. A most wonderful improvement has been made in quality, for Pliny speaks of the pears of his time as "hard, astringent crabs," which had to be cooked to be eaten; but how different now! When these are compared with our own delicious "Seckel," or most of our foreign varieties, they well deserve the epithet of "Beurre,"—literally *buttery*,—for they fairly *melt* in the mouth. The important place which the pear occupies on the list of our best fruits, demands for it skilful, intelligent cultivation, a practical knowledge of the business. Many have been the articles written on pear-culture, "both lean and lengthy," of fabulous *theories* that have misled those who have followed them. Our aim in this essay is to be practical in all the principles of successful culture. We have carefully considered the subject, and our ex-

perience and observation lead us to treat it under five heads, namely, Soil, Situation, Planting, Culture and Varieties.

The *first* is one of the greatest importance to successful culture. The pear delights in a deep, rich, mellow and somewhat moist

SOIL,

but will exist in a variety of soils, although it attains greatest perfection in clayey loam. Even on stiff clays the trees will grow and produce very satisfactorily, under the ameliorating influences of the preparation and culture which such soils require. Draining first and subsoiling afterwards are the chief requisites for gradual amelioration. In short, while a water-soaked clay soil is the most utterly worthless of all lands for the growth of any crop, a properly drained and aërated clay soil is by far the most valuable, and only requires careful management to render it available for the best productions of the orchard, farm or garden. The chief precaution in managing a clay soil, is never to work on it while wet, but only when it is dry to friability. Sandy soils, or those of a gravelly character, are not well adapted to the pear.

In these soils, so variable in their degree of moisture, the trees (especially the foreign varieties) ripen prematurely, and drop their foliage early, if the weather proves dry towards the end of summer; then, in the event of moist weather following a period of drought, a late secondary growth will be produced, which, failing to mature, induces a tendency to blight and disease. Surface-dressings of compost, thorough cultivation or constant mulching, will counteract to some extent the effects of uncongenial soil for the pear-roots. For this soil we should recommend the dwarf-tree, as the roots of the quince can be confined to a small area, which may be prepared and maintained to meet all the requirements of growth. Although we have many instances where some varieties, such as the "Buffum" and "Louise Bonne de Jersey," have succeeded finely on sandy loam, yet as a rule none of our land is too good; choose the best; such land as would raise heavy corn, grass or vegetables,—deep and rich. An eminent pear-grower says: "The best soil for a pear-orchard is a dry, deep, substantial soil, between sandy and a clayey loam, and possessing among its inorganic parts a consider-

able portion o' lime. On such soils we find the greatest and most enduring vigor and fertility, the healthiest and hardiest trees, and the fairest and best flavored fruits." It has been observed that fruit grown on clayey soils keeps better than that grown on light soil.

SITE AND SHELTER.

Next to soil, it is important to have a good situation for successfully growing the pear. All very low situations should be avoided, on account of the greater extremes of temperature prevalent in valleys than in places of elevation. A sloping hill-side facing south forms the choicest site for a pear-orchard. The necessity of shelter, or the efficacy of protection, is now generally understood. In bleak localities, the best protection may be had by planting a belt of evergreen trees in a hedge form around the orchard on the north, west and east sides, to shelter it from the cold drying winds of winter, so hard on the trees, or the force of the autumn gales, so destructive to fruit. The best varieties of evergreens for this purpose are the Norway spruce and our common white pine; they should be planted about four or five feet apart, and in time, and with a little pruning, will form a dense hedge. The shelter required is not so much to repel or alleviate mere thermometric cold, as to arrest evaporation and exhaustion of vitality by checking the rapid and penetrating action of dry winds.

PLANTING OF THE TREES.

A very important point is the judicious planting of the trees; if the soil has been properly prepared by deep tillage, the holes for the trees may not be any deeper than enough to properly cover the roots, but wide, giving all the roots plenty of room. Very deep planting, or quite shallow, are the injurious extremes in sett ng trees. A safe rule would be to set the tree a little deeper than it stood in the nursery-row.

It is infinitely better to plant so that some future surface-dressing may be required to cover the swelling, exposed roots, than to have them buried in a cold, lean subsoil, beneath the ready influence of atmospheric heat and air, as all trees need the heat of the sun to perfect their fruits. The soil

should be carefully sifted around the small roots; here lies the great secret in transplanting trees of any kind—to have the soil come firmly in contact with every root. Let each root and fibre be straightened out with care, and good, rich, fine soil be well worked in around them so that all the cavities will be filled. When the soil has become sufficiently dry, press it down *firmly* with the foot. Never allow rank or unfermented manure to come in contact with the roots, although a good rich compost may be mixed with the loam at transplanting. After the trees are set out, a very important item of after-culture is mulching, which is the preservation of a proper degree of moisture in the soil surrounding the roots of the tree. Any loose material will answer as mulch, such as coarse manure, straw litter of any kind, or fresh-cut grass—even old tan-bark or refuse charcoal-dust may be used.

The mulch should not be applied till about the middle of June, unless the weather proves very dry and hot previous to that time, and on good clean ground it may remain during the following winter. A good protection should be given every fall against the severities of winter. The dwarf-trees especially, need protection, as their roots are tender, and must have winter covering. A barrow-load of manure placed around each tree is a sufficient protection against mice and extreme cold.

A word as to the selection of trees. The best age for transplanting is two or three years from the bud; good, vigorous, thrifty, well-rooted specimens should be taken. The best distance to set the trees apart, is fifteen feet for standard pears—if the orchard is to be *wholly* standard trees—taking one hundred and ninety-four trees for an acre; for dwauf trees, eight feet apart, which will require six hundred and eighty trees for an acre. But if the orchard is to contain both kinds, the standard should be set twenty feet apart, with the dwarfs equidistant between, which will take four hundred and thirty-five. The pear is eminently *the* tree for the pyramidal form, either on the free stock, or on the quince. On the latter, however, the trees bear much earlier, are more prolific, easier managed and consequently preferable for small gardens. Many varieties, however, do not succeed on the quince-root; but still a large number of the delicious, melting

varieties do, and produce a finer fruit on it, than on the free stock. The tardiness of bearing of the pear-tree, when grown in the ordinary standard form on free stock, has, more than any other cause, retarded its general cultivation. No better proof of this can be adduced than the general partiality now shown for trees on quince stock that bear at the age of four or five years. The introduction of the trees a few years ago, was really the first thing that gave a general impulse to pear-tree planting. With most people it is a very important thing to obtain fruit in three or four years instead of waiting eight or ten, as it generally takes about that time to bring trees on free stocks into a bearing state, unless it be some remarkably precocious variety. Therefore, those who wish pear-trees for pyramids, that are easily managed and will bear early, should select them on quince stocks, in case the varieties they wish to cultivate have been proved to succeed well on it.

Referring to the beauty of the tree, as to form or shape, the pyramidal is the best. As for fine ornamental forms, some varieties, such as Flemish Beauty, Lawrence, Buffum, Barronne de Mello, Urbaniste and Howell, cannot well be excelled, especially when the additional attraction of a fine crop of fruit is taken into consideration. As to the mode of treatment or

CULTURE,

the condition of the trees will indicate the treatment required.

To cultivate or not, is to be determined by climate and condition of soil, the chief object being to maintain health and encourage fruitfulness. When the trees are young, the culture should tend to encourage a judicious growth; our rule is to keep the trees growing vigorously until they have attained considerable size and commenced bearing. The trees should receive a good, clean cultivation through the spring and summer months, but not late in the autumn, as this is conducive to late growth and unripened wood, which brings disease and eventually death to the tree. The desideratum in fruit-culture is *well-ripened* wood. All useful cultivation begins and ends with this object in view, and it is the criterion of good or bad management.

When an ample, luxuriant growth is secured, all surface-cultivation should be stopped; the orchard laid down to grass;

a thorough cultivation to be again practised when the trees indicate its necessity. A very important part of pear-culture is judicious

PRUNING.

The tree is usually a victim to excessive pruning. "It is *pruned* in winter to make it grow, and *pinched* in summer to make it fruit." Severe summer pruning is very conducive to blight and disease, has a tendency to produce a secondary growth, consequently immature wood, and we believe that no cause is so fruitful of failure and disappointment in pear-culture. If there should be unusual rampant growth, it may be checked in the right season, late fall, at which time a proper thinning out of surplus branches should be made; all the pruning that is required, is to keep the proper symmetry of the tree, and open-headed, so as to let in light and air.

When a tree is transplanted and has its roots more or less mutilated during the process of removal, common sense points to the propriety, and practice proves the necessity, of a judicious thinning out of the branches; but when the balance of power between the roots and branches is again fairly restored, pruning, unless to rectify abnormal growths, is certainly of questionable utility. When the foundation of the tree is fairly established, any farther pruning should be carefully and sparingly performed; great mistakes are constantly made by supposing that a yearly pruning is a necessity.

Instead of "shortening in" as it is termed, the annual growths at winter pruning, fruiting spurs will be more certainly and much earlier developed by leaving the growths untouched. This winter shortening of the previous year's growths, results in increasing the number of slender shoots—a good practice for the production of basket-making material when confined to the willow, but a very useless one on the pear where fruit is the main object. Selection of

VARIETIES.

With all the proper modes of culture and care in selection of site and soil, with judicious planting and pruning, unless there is a careful selection of varieties, success will be the exception and disappointment the rule. It is a most important point: the selection must in all cases be made with reference

to the special purposes for which they are intended. For the fruit-garden, the selection should be adapted to the wants and circumstances of the grower. He must regulate the proportion of the cooking and table varieties—the sweet and the acid—the early and late varieties—for, without considering well all these points, a man may sit down and select what are called "*the best* varieties," and yet find himself greatly disappointed when they come into bearing; for so it happens, that a variety that may be *best* for the *dessert*, will be exceedingly unprofitable for other purposes. All these points should be duly considered. And the same discrimination must be exercised in the selection for the "Market Orchard," of varieties that are adapted to the modes of culture intended to be pursued and the market to be supplied. All orchard fruits should, *first*, as to the trees, be hardy, vigorous and productive; the fruit should be of good size, fair appearance, good keepers, and of good quality. It should be borne in mind that many of the best fruits are very unprofitable for *general* market culture. For a list of twelve profitable varieties for the orchard on the pear stock, we would name: *First*, the old *Bartlett*, which succeeds everywhere, and has no competitor; as a summer market fruit, it is emphatically *the* pear for the "million." "*Clapp's Favorite*," a new variety, of great promise, very productive, fine form and color, a cross between the Flemish Beauty and Bartlett; the tree resembles the former, the fruit the latter, with the exception of its musky flavor. "*Beurre d'Anjou*" (the *ne plus meuris* of the French), one of the very best and most valuable pears grown. "*Beurre Clairgeau*," a splendid French pear, a vigorous, early bearer; although a little variable in quality, yet its fine size, beauty and productiveness make it a very profitable variety. Another fine foreign variety is the *Beurre Rose*, a large yellow pear, often tinged with red, of a deliciously perfumed, rich flavor, and abundant bearer; its splendid appearance and fine quality make it one of the most valuable for the market. The *Doyenne Boussock*, of Belgian origin, is a fine, deep yellow pear, with red cheek in the sun; a vigorous tree, an early bearer; profitable sort. Having mentioned a few of the best foreign varieties for orchard culture, we will now fill out our list from American seedlings.

The first-named, as one of the oldest, *Buffum*, from Rhode Island, a medium-sized, sweet, juicy yellow pear; the tree of remarkable upright growth, productive bearer, hardy, and will flourish on a sandy soil where others will not succeed. The *Howell*, from Connecticut, one of the most beautiful and excellent of pears, an early and prolific bearer, hardy tree, fruit very attractive, and bears handling well. Still another Connecticut variety of merit is the *Onondaga* or *Swan's Orange*, a large, rather uneven-skinned, orange-colored pear of fair quality; the tree a strong grower, hardy and very productive. We have two sorts from the "Empire State," of first-class merit, the *Sheldon*, a very fine October pear of excellent quality; a vigorous, hardy tree, which bears regular and abundant crops. There are few better pears than the Sheldon. It should be gathered early, and used immediately, for, like the Flemish, Clapp's, and Giffard, it is not a long keeper. The other, the *Lawrence*, which we think will soon be our standard winter pear, justly deserves the title; the more it is known the better it is liked; a variety that will be extensively planted for market. Among the latest introductions of new foreign varieties, there are two fine, large, late sorts that are very promising. The first, "*Souvenir du Congress*," very large, pyriform, beautiful yellow, with red cheek in sun, with melting, juicy flavor. Some extra fine specimens were shown at the late pomological exhibition at Boston. The other, *Williams' d' Hiver*, which promises to be a winter Bartlett, of which we think it is a seedling; in form, color, size and flavor surely, resembling it. It has been very highly commended.

We also briefly describe six varieties that are best adapted to the dwarf stock for market culture. It should always be borne in mind that in growing the pear on quince stock the "Anger" variety should be used—never our common quince-root, as it cannot support the strong-grown pear-tree on its small roots. Our first, the delicious *Belle Lucrative*, well known for its rich, juicy flavor; a healthy, hardy tree, and very productive. Next in popularity to the famous Bartlett, among the market-growers in all sections of the country, stands that noble pear, the "*Duchesse d'Angouleme*, which, with the *Beurre d'Anjou*, are unquestionably the best two

sorts that our French cousins have ever sent us. This valuable kind is most successfully grown on the quince stock. We have known of the fruit selling for twenty-five dollars per barrel, then to be retailed at a profit. *Louise Bonne de Jersey*, a very handsome, rich vinous and excellent pear, grows well as a dwarf; a profitable market sort. The *Urbaniste* is one of the very best flavored varieties; the tree of model form, hardy and abundant bearer at maturity, very valuable for the dwarf-pear orchard. For two winter sorts as dwarfs we would select the "*Vicar of Winkfield*," a large, long pyriform, pale yellow, brownish cheek; when well grown, of fair quality, an excellent cooking-pear; the tree hardy, vigorous, and wonderfully prolific; is very apt to be overladen, and should be thinned. The other sort, "*Josephine de Malines*," a comparatively new pear, but is rapidly gaining favor, —a melting, delicately-perfumed pear of first quality, an excellent keeping variety, often until spring; it is truly one of our very finest winter pears. The above lists are intended for the commercial market rather than a selection of choice amateur varieties for the dessert or table. In such a list, as wide a range of flavors as possible should be secured, and a succession of fruit from the earliest to the latest, and to form this list we have nearly or quite one thousand varieties to draw from.

A friend of ours has a collection of nine hundred varieties, and still *is adding*. A noticeable fact is, that the two varieties that are the standard of quality are both of American origin —*Seckel*, and *Dana's Hovey*, which is practically a *winter*, Seckel. We might go through a long list, giving their characteristics as to quality, &c., but our limited space is already passed, and if the above hints and suggestions are of any service to our pear-growers, we are repaid for giving them.

FARMING IN NEW ENGLAND.

PLYMOUTH.

From the Supervisors' Report.

If the record of successful and unsuccessful attempts to raise premium crops does not furnish conclusive evidence of the truth of the proposition, that farming has not yet become one of the exact sciences, an abundance of corroborative testimony may be found in the manifold replies, given by farmers and others, to that most important of all the questions relating to their common interest, "What can the Plymouth County farmer most profitably raise?" One will confidently answer, grass; another, potatoes; another, fruits; while still another, not wholly regardless of the traditions and experience of the past, may timidly suggest, Indian corn; and so on through the entire list of farm products. Each professedly favors some special crop, for specialties are just now in fashion; but each one's specialty is apt to be temporary in its nature, and, even for the time being, theoretical rather than practical, the essential idea of special farming requiring the devotion of one's whole energies to the production of some single crop to the exclusion of all others.

One will tell us of a hundred bushels of corn purchased from the proceeds of a single square rood of potatoes. He may fail to report the number of days' labor and the number of miles of travel expended in raising and retailing the crop; but he will scarcely fail to have growing somewhere upon his premises some scattered patches of—well, something besides potatoes,—as a dernier resort in case his favorite crop should prove unreliable. Another informs us of a thousand dollars' worth of Indian corn, cultivated and harvested for thirty-three dollars, or three and one-third per cent of its value. We

must, perforce, accept the statement, even if we do so with a degree of hesitation incompatible with implicit faith in gubernatorial infallibility. But while we are wondering at the boundless possibilities of profit from corn-raising, thus shadowed forth, there comes another specialist, who, with almost a sneer at this despised crop, and, perhaps, a shade of pity for the benighted mortals who favor it, assures us that two bushels of potatoes can be produced at as little cost as one of corn. A few years since, at a meeting in the society's hall, it was demonstrated, to the satisfaction of some enthusiastic individuals, that the farmer's open road to wealth was to be found in raising turnips at seventy-five cents a bushel. Last year the turnip-crop was almost a total failure in this vicinity, and it will scarcely prove remunerative the present season.

Opinions differ as widely in respect to fertilizers as to crops. One believes that only excrementitious manures are worth applying, and that, except in bulk, nothing is gained by mixing them with other substances, the labor incident to the process being misdirected and profitless. Another advocates the composting of all manuring substances, believing himself well employed while mixing and combining all manner of waste and decaying matter, vegetable or animal, with any attainable salts, earths, or other minerals; and a third will urge upon both the others that they can afford to give away their bulky manures rather than be at the expense of removing and applying them, and supply their place with some modern invention which need only be applied in almost infinitesimal quantities. Verily, in the multitude of *such* counsellors there can be only confusion.

But at the foundation of each of these individual peculiarities of belief, there is a stratum of sound common-sense, which enables its possessor to discern apparent truths, but which does not prevent his drawing hasty conclusions from a partial knowledge of facts, as in assuming that what has proved true within his own observation must necessarily be true in the experience of all other men. With certain limitations, special farming is to be recommended; but its best recommendation to each farmer must be found in the result of his own operations upon his own farm, as affected by the nature of the soil, the cost of production, and the requirements of the

market. If, in view of these considerations, any single crop is, in his judgment, more reliable and profitable than all others, he may wisely make its cultivation his special business. But he need not forget that, to the extent of his own necessary consumption, any other crop he may raise will be marketed without expense, and paid for without loss, as soon as it is harvested. Neither should he lose sight of the fact that the repeated raising of the same crop upon the same land may not prove good husbandry in the long run.

And any crop may fail in some seasons and under some circumstances. What was true of turnips and cranberries last year, and partially true of grapes and strawberries the present year, is liable, at some time, to prove true of any other crop. Because one farmer has realized a large profit from a fortunate venture in squashes, or another from a mammoth crop of cabbages, it does not follow that all may safely raise squashes only or cabbages, regardless of the possibility that the borer may destroy the one, or some species of fly or aphis the other. The experience of scores of years has resulted in a very general belief, if not conviction, that, in a region where an untimely frost, the prevalence of rot, the development of some anomalous form of insect life, a mile-wide opening in a summer cloud, whereby the needed moisture fails, may make all the difference between an abundant and a meagre harvest, it is not wise for a farmer to risk his whole chance of success upon a single venture.

I have said that the advocacy of special farming is fashionable. But this fashion is apparently giving place to another, which is, like most other fashions, absurd, and, like some others, pernicious. I mean that of characterizing all farming in Plymouth County as "played out" and profitless. If this fashionable cant means that in this county men cannot grow rich by farming, it is a part of the truth, the counterpart being that farmers never did, and never could, accumulate large fortunes, measured by any standard now recognized. The reputable modes of acquiring wealth (excluding inheritance and mere chance, neither of which can be properly termed acquisition), although many in number, are all based upon a few general principles which underlie the economy of business relations.

The operation of one of these principles is seen in the retention and conversion by one individual or corporation of a portion, more or less considerable, of the earnings of each one of a large number of employés or operatives, as is too often practiced in certain manufacturing industries. This principle, although formerly a controlling one in the plantation system in the Southern States, never was, never ought to be, and, it is earnestly to be hoped, never will be, applied to agricultural operations in New England.

Another of these principles is that of the repeated turning of capital, in some form of stock in trade, even at a comparatively small percentage of profit on each transaction. The farmer cannot take advantage of this principle, the frequent turning of his capital being impossible. He may invest a thousand dollars in a crop of corn, and realize a profit of twenty per cent., or even more, on his investment. But the operation cannot be repeated until another year. His neighbor, who invests a thousand dollars in Western corn and turns it every week at a profit of five per cent., will be some twelve hundred per cent. ahead of him at the end of the year, which is not an encouraging result to one who only desires to become rich, or, at least, as rich as his neighbor.

A third principle is that of employing a large capital in enterprises requiring considerable time for their consummation, but which return at the end a very considerable margin of profit, as in certain commercial transactions with foreign countries. But there are limits to the amount of capital which could be employed by New England farmers, even if the capital were at their disposal. The frequent subdivision of property, under our statutes, renders it difficult to acquire, and still more difficult to perpetuate, a large landed estate, which seems to be a necessary preliminary to any extensive outlay for permanent improvements. It would be nearly, or quite, impossible to procure fertilizers containing all the elements necessary to replace in the soil the loss consequent on the repeated croppings which must result from the application to farming of the high-pressure system on which other money-making operations are conducted. It is useless in farming to expect something from nothing. The original accumulations of fertilizing elements, never very abundant here, were long ago

exhausted, or nearly so, and the present productive capacity of the soil cannot greatly exceed what is due to the plant-food annually returned to it, the amount of which cannot be indefinitely increased. Doubtless, the earth's waste, could it all be made available, would maintain the earth's fertility.

But this waste is not, nor is it likely to be, at present, generally utilized. Portions of it, from sanitary considerations, are buried so deeply in the earth as to become useless; other portions are carried by the winds to regions sterile and unproductive; while much the larger part is swallowed up by the ocean, to be deposited where it will be beyond the reach of vegetation, at least, until after some new and gigantic upheaval of the earth's crust. There are those, it is true, who profess to be able to supply, in unlimited quantities, any of the elements of plant-food, but they have not yet been able to secure from the public full confidence in their professions.

But, probably, the chief objection to the free investment of capital in the permanent improvement of farms is, that its owner virtually loses control of it. It may, for the time being, return a large profit, but this will be rather in the nature of a purchased, but uncertain, annuity, the present worth of which bears no fixed relation to the capital originally invested or to the income derived from it. The sinking of capital in annuities is not in accordance with the genius of our institutions, especially where there can be no insurance against an occasional failure of income through untoward influences.

If it is asserted that capital invested in the improvement and high cultivation of a farm can, at any time, by the sale of the farm be reconverted to cash without loss, the assertion must stand for what it is worth. It certainly is not a proposition so self-evident or so well established as to receive the assent of capitalists.

One other principal, and a common one, through the operation of which wealth is acquired, is that of hazardous speculation upon credit, or reckless ventures with other men's money, which, if successful, will make only the operator rich; if unsuccessful, will make only other men poor. Whether this method of acquiring wealth is reputable or otherwise (and that there is any doubt on this point indicates a low

standard of morals in the community), it is not within the range of the farmer's opportunities.

It follows, then, that if the assertion that farming is "played out" means that farming is not a promising road to wealth, it is undeniably true. But if it means that Plymouth County farmers fail to secure a comfortable subsistence, fail to educate their children, fail oftener than other men to pay their honest debts, fail, as a class, to discharge creditably their obligations to society, or even fail, in any unusual degree to secure the respect of the community, the allegation is untrue and discreditable to the judgment or the candor of those who make it.

But the fact that farmers seldom confine themselves wholly to the legitimate operations of the farm, but resort more or less extensively to other avocations, is urged as conclusive evidence that farming is not a living business. The fact itself must be admitted; but the conclusion does not follow necessarily. In our climate but few if any of the most important labors on the farm can be advantageously performed between November and April. It is certainly creditable to farmers, as a class, that they have the disposition and the ability, in the interim, to direct their energies to the successful prosecution of other business, at least to such an extent as to relieve themselves of the imputation of idleness, and to add something, if necessary, to an otherwise slender income. But whatever may be the reason, it is no uncommon thing in Plymouth County to find men who are good farmers, and, at the same time, good mechanics, acceptable preachers, successful manufacturers, or of reputable standing in other callings or professions. And it is no inconsiderable item on the credit side of the farmer's account with life, that this alternation or combination of employments enables him to escape the wearisome monotony incident to some other avocations, which, for months and years, perhaps for life, confine those who adopt them to the self-same bench or desk, compel them to repeat continually the self-same processes, to exercise the self-same muscles, or the self-same class of mental faculties, where any mental effort may be required beyond the training supplied by mere habit. It will be easily conceded that, except for the impossibility of acquiring wealth, many a harassed employer,

many a wearied employé would willingly submit to the inconveniences and possible privations, to which the farmer is subject, to be assured of that independence which enables him to control his own movements, in despite of the clang of the inexorable bell or the shriek of the untiring engine; and to sleep undisturbed by fears of protested notes or rumors of impending or anticipated financial panics. And to this complexion must come, at last, the whole question of comparative advantage, viz.: whether it is better to seek the reasonably certain comfort which may be honestly earned by tilling the soil, or to risk everything for the remote possibility of wealth incident to some other callings.

But an impression prevails in the community that, at the West, agriculturists can surely and rapidly acquire fortunes.

But, even there, farming has its drawbacks, and those who follow it labor under difficulties which are not within our experience, and which we can hardly appreciate. A farmer in Kansas, formerly a citizen of our own county, raised, last year, some twenty acres of corn, any single acre of which, if raised by a member of this Society, would insure a larger sum as a premium than could be realized in Kansas from the sale of the whole product of the acre. One-half of this crop he held over the year in the vain hope of an advance in price. It is now worth, as appears by a recent letter, less than ten cents a bushel, and no demand at any price. Another of our well-known citizens, now travelling in that part of the country, says in a published letter: "The farmers in the Old Colony would do well to think twice before emigrating to the West. It is not all poetry or profit here. Success must be preceded by unremitting toil and by any amount of privation."

And the secretary of the Illinois Farmers' Association is reported to have said, in a public address, that in that beautiful State, which we have been taught to consider the paradise of producers, "farmers live in houses with curtainless windows, from whose broken panes flutter the signal rags of poverty"; and that, "possessed of as rich a soil as the sun shines upon, seven-tenths of all its farms are under mortgage." A tithe of the opportunities for observation that have fallen to the lot of your Supervisor would suffice to show that the farmers of Plymouth County are not the occupants of houses with di-

lapidated windows, nor are their names oftenest found upon the records as grantors in mortgage deeds; that their labor cannot be truthfully described as "unintermitting toil," nor their comparative want of means as excessive "privation."

Doubtless to one who is able to expend thousands annually upon his habitation and its accessories, the average farmer's home appears homely indeed. In this contrast between comfortable competence and superfluous luxury may be found one cause of the popular distaste for farming as an occupation. The fact that farmers can, and do, surround themselves with conveniences and comforts which, a few generations ago, would have been unattainable luxuries to the richest in the land, is wholly forgotten, in view of the more patent fact, that, to-day, some fortunate manipulator of money fares sumptuously, challenging the envy of the world by the splendor of his surroundings.

The precept, "Avoid extremes," has, as applied to this subject, a significance which few seem to recognize, and fewer still to comprehend.

"But," says one, "am I advised to pursue, voluntarily, an avocation admitted to be comparatively unremunerative, when all the avenues to wealth and social position are as widely open to me as to others?" Not necessarily, by any means. If any one deems soiled hands more objectionable than a soiled conscience, the advice is not for him. Neither will it commend itself to him who believes the accumulation of great wealth to be the highest end and aim of life; nor yet to him who recognizes, in the prevailing demoralization of business relations and of business men, his congenial opportunity to reach that coveted goal of a doubtful ambition. To all such the invocation, "give me neither poverty nor riches," is the thought, not of a wise man, but of a fool. They have evidently no call to be farmers. Different fields are theirs to till, where honor may be reaped by successful strategy and where illicit spoils are deemed legitimate harvests by craft and cunning.

ALDEN S. BRADFORD, *Supervisor.*

EXPERIMENT WITH COMMERCIAL FERTILIZERS.

FRANKLIN.

Statement of D. O. Fisk.

This experiment was made upon two acres of ground, one-half bearing potatoes the year previous and one-half sowed with oats the same year; lightly manured this year with barn-yard manure, evenly distributed and ploughed in, the rows running east and west or crosswise of the oat and potato field of 1872. We put equal values of the several fertilizers in the hill, eight rows of each of the following-named varieties, to wit:—

Enoch Coe's Phosphate.
Oscar Foot's Bone.
Wilson's Superphosphate.
Stevens' Mineral Fertilizer, N. H.
Bay State do.
Plaster and Hen Manure.
Green Mountain Soluble Phosphate.
Sea Fowl Guano, Bradley's.
Bradley's X L Superphosphate.
Quinnippiac do.
Zell's do. from Baltimore, Md.

Owing to the cold and backward spring, some of the corn failed to come, and at the first hoeing, where a hill was missing, we planted white beans, as is our usual custom. This corn was treated in all points alike, being well hoed three times, cut up by the roots the 2d of September, four rows to a stook, making two rows of stooks to each sort, and a good load of each, and husked by itself and weighed on the ear or

basket of $1\frac{1}{2}$ bushels. Weight, 68 pounds on the ear and 57 shelled.

The respective result in yield was as follows :—

	Corn, bush.	Beans, bush.
Bradley's X L Superphosphate, . .	21	1
" Sea Fowl, ...	20	1
Green Mountain Soluble, . . .	$19\frac{1}{2}$	1
Enoch Coe's do., ...	19	–
Oscar Foot's Bone, ...	18	$\frac{1}{2}$
Wilson's Phosphate, ...	$17\frac{1}{2}$	1
Quinnippiac, ...	$17\frac{1}{2}$	–
Bay State, ...	17	–
Zell's Fertilizer, ...	17	–
Plaster and Hen Manure, . . .	16	–
Stevens' Mineral, ...	$14\frac{1}{2}$	$\frac{1}{2}$

Of the above number, Zell's and Quinnippiac arrived so late that they could not go in on the two acres, but were put in a piece adjoining with the same preparation of soil.

The prime benefit or good result derived from the use of these valuable fertilizers this year, was in bringing forward an early ripening of the corn and beans, there being no soft corn in the whole lot and only three bushels of mouldy "nubbins" in almost two hundred, so that we decided that the use of them is of great service and of real value as a "stimulant," especially in our short season, when Jack Frost puts in his appearance as early as the last of September.

D. O. Fisk.

CEREALS.

PLYMOUTH.

Statement of Spencer Leonard.

Indian Corn.—The land on which my corn grew, one acre, had been mowed five years without any top-dressing, the yield for the last two years being about three-fourths of a ton per year.

About Sept. 1st, 1872, it was ploughed seven or eight inches deep, 65 bushels of leached ashes spread on the surface and winter rye sowed. May 23d to 25th, 1873, 27 loads, of 30 bushels each, of manure from under my stable was spread, and, with the rye, ploughed in about eight inches deep, and the ground harrowed twice. One load of hen-manure and night-soil, mixed with earth (one part manure and three parts earth), was put in the hills, which were three feet four inches apart one way, and about two feet the other, and smutty white, or hill corn planted May 28th, four kernels in a hill; a cultivator was run through it three times, and it was twice hoed with hand hoes. The stalks were cut in September. It being very dry at the time of planting, the corn came up unevenly and grew very slowly the first two months, earing out very near the ground. The ears were abundant, grew to a large size and filled out well. The Supervisor harvested two rods in different parts of the field, October 22d, which yielded 55 7-8 lbs. of ears per rod, or 8,940 lbs. per acre, which at 85 lbs. to the bushel gives 105 15-85 bushels, the stover weighing $3\frac{1}{2}$ tons. Expenses: ploughing, &c., $10; manure, $75; seed and planting, $5; cultivation, $9; harvesting, $17; total, $116.

The charges for labor in the foregoing statement of Mr. Leonard are larger than those usually returned by competitors, but they are probably none too large. The manure is charged

at nearly twice the usual rate, from which it must be inferred that no allowance is made for any part of it not consumed by the crop. If we consider the 105 bushels of corn as the only return for the $116 expended, the operation would appear to be a losing one. But it is so only in appearance. The stover at present prices is worth nearly or quite half as much as the corn; the ashes applied will benefit succeeding crops for many years, and the value of the stable-manure remaining in the soil is not inconsiderable. Although competitors are required to return the value of the manure applied to their land, no correct estimate of the cost of any crop can be made unless we first ascertain what proportion of the manure applied is appropriated by that crop, which is manifestly impossible.

Statement of Albert Thomas.

OATS.—Oats were raised on 180 square rods of dark, sandy loam, upon which I raised corn in 1871, when it was manured at the rate of 40 loads, of 30 bushels each, of barn-cellar manure per acre. In 1872 it was planted with potatoes and turnips, mainly the former, and was then manured with 20 loads of similar manure. It was ploughed twice in April, 1873, about nine inches deep, and sowed with grass-seed and $3\frac{1}{2}$ bushels of oats, April 20th. The oats looked badly in the dry weather, but were benefited, I think, by the deep ploughing, and they finally came out well. Cradled July 20th, and threshed about Sept. 10th. The product, as appears by the accompanying sworn certificate, was 2,275 lbs., or $71\frac{1}{2}$ bushels of oats, and $1\frac{1}{2}$ tons of straw. Expenses: ploughing, etc., $8; seed, $2.25; harvesting, $8.18; total, $18.43.

Statement of Galen Latham.

WINTER RYE.—My rye grew on 170 rods of thin, gravelly soil, on which, in 1871, I ploughed in about 125 cart-loads of meadow muck, and six cords of compost manure, and planted Indian corn. The crop of 1872 was winter rye, manured with six cords of muck and manure, composted. The same quantity of compost of yellow loam and manure was ploughed in with the stubble, and winter rye again sowed, Sept. 20th, at the

rate of one bushel per acre. Harvested July 15th, by cradling. Product 1,290 lbs. of rye, or $21\frac{7}{10}$ bushels, very nearly, per acre, and 3,180 lbs. of straw. Expenses: ploughing and other preparation, $5; manure, $30; seed and sowing, $3; harvesting, $5.50; total, $43.50, or at the rate of $40.94 per acre.

ROOTS AND VEGETABLES.

MIDDLESEX NORTH.

Statement of H. E. Worcester.

Our Early Rose potatoes, one bushel of which we offer as a sample, were grown on light, upland soil, with a southern slope. In 1871 it bore a light crop of hay. In 1872 it was ploughed and planted with late cabbages. Last spring it was ploughed to a depth of ten inches, and six cords of barn-yard manure spread on. It was thoroughly harrowed, and drills, three feet apart, made with a horse-plough. It was planted May 14th. For seed, we chose medium-sized potatoes, cut them into four pieces, and dropped the seed two feet apart in the drill. Wood-ashes, at the rate of eight bushels to the acre, were put in the drills. They were hoed three times, and dug the last of July and first of August.

Summary.—*Cost of One Acre of Early Rose Potatoes.*

1.—Seed, eight bushels, at $1.25, ...	$9 20
2.—Manure removed by crop, ...	12 00
3.—*a.* Carting and spreading manure, . . .	5 00
b. Ploughing, one day, man and two horses, .	5 00
c. Harrowing, half " " " . .	2 50
d. Planting, ...	3 00
e. Cultivation, five days, man and one day horse, ...	11 50
f. Harvesting, ...	16 00
4.—Interest and taxes, ...	16 00
Total cost, ...	$80 20

RECEIVED.

Sold 150 bushels,	$187 50	
Cost of marketing,	15 00	
		$172 50
Profit per acre,		$92 30

150 bushels of potatoes=9,000 lbs. contains—

Nitrogen, 28 lbs., at 25 cts.,	$7 00
Potash, 50 lbs., at 5 cts.,	2 50
Phos. Acid, 16.2 lbs., at 15 cts.,	2 50
Value manure removed by crop,	$12 00

RUTA BAGAS.—Our turnips—Carter's Imperial Purple-Top Swede—were grown on a light sandy loam soil, "broken up" last spring. The ground was ploughed to a depth of ten inches with a large Holbrook "Side Hill" plough, and afterwards well pulverized with a heavy harrow. Drills, three feet apart, were made with a light horse-plough, and five cords to the acre of well-rotted barn-yard manure strewn in the drills. This was covered with a plough, and the ridges levelled and lumps removed with rakes. The seed was sown June 20th.

The young plants were thinned to eight inches to a plant. This is our usual method with this crop, and it seldom fails us.

As this year's crop has not been harvested, we give the data of the crop of 1872, which was an average one,—certainly no larger than this year's will be, and the price a fair average one. Last year's crop was not all housed, the major part being taken from the field to the cars.

SUMMARY.—*Cost of One Acre of Swedes.*

1.—Seed,	$1 00
2.—Manure removed by crop,	22 50
3.—*a.* Carting and spreading manure,	5 50
b. Ploughing, one day, two men and three horses,	8 50
c. Harrowing, one day, one man and two horses,	5 00
d. Preparing ground and planting,	5 00

e. Cultivation,	$15 00
f. Harvesting,	6 00
4.—Interest and taxes,	16 00
Total cost per acre,	$84 50

RECEIVED.

Sold 195 cwt., for	$139 06	
Cost of marketing,	10 00	
	$129 06	
Fed 70 cwt., worth, at 50 cts.,	35 00	
		164 06
Net profit on one acre,		$77 56

14 tons of Swedes contains of—

Nitrogen, 54 lbs., at 25 cts.,	$13 50
Potash, 90 lbs., at 5 cts.,	4 50
Phos. Acid, 30 lbs., at 15 cts.,	4 50
Value of manure removed by crop,	$22 50

BEETS.—Our beets were sowed on ground which has been in cultivation for many years, and last year, 1872, bore two crops, one of each pease and the other of English turnips.

This spring the ground was ploughed deep, twelve inches, and eight cords to the acre of stable-manure was harrowed in. The seed was sown with a seed-sower in drills two and one-half ($2\frac{1}{2}$) feet apart. A sample-piece, one rod square, was measured, and its product weighed to get the yield per acre. As many of the beets were sold early in the season in bunches, the value of the crop cannot be *exactly* given, but $1.25 per barrel, of one hundred and fifty pounds, is a fair price, and certainly low enough.

SUMMARY.—*Cost of One Acre of Beets.*

1.—Seed,	$1 00
2.—Manure removed by crop,	40 00
3.—*a.* Carting and spreading manure,	6 00

b. Ploughing, one day, one man and two horses,	$5 00
c. Harrowing, half day, one man and two horses,	2 50
d. Preparing ground and planting, . . .	2 00
e. Cultivation, ...	15 00
f. Harvesting, ...	6 00
4.—Interest and taxes, ...	16 00
Total cost per acre, ...	$93 50

Cr. by 25 tons, at $16, ...	$400 00	
Less cost marketing, ...	15 00	
		385 00
Net profit per acre, ...		$291 50

25 tons of beets contains of—

Nitrogen, 90, at 25 cts., ...	$22 50
Potash, 215, at 5cts., ...	10 75
Phos. Acid, 40.5, at 15 cts., ...	6 08
Value of manure removed by crop,	$39 33

(Mem.—The potato "tops" were burned, the ashes spread and ploughed in. The beet "tops" are ploughed in, and, of the turnip-tops, a part are fed and the remainder ploughed in. The turnip "tops" we feed we calculate of equal value for either fodder or manure.)

Henry E. Worcester.

ESSEX.

Statement of Albert Titcomb.

Onions.—In 1871 the crop was onions. Manure from barn cellar, about thirty loads to acre was used.

The crop of 1872 was onions, and about the same kind and quantity of manure was used as in 1871. A strong floury soil with clay bottom.

For the crop of 1873, ploughed once the previous autumn, about five inches deep; after ploughing we applied thirty loads of thirty bushels each, barn-cellar manure on the top. In the spring the land was thoroughly pulverized with the wheel, tooth and brush harrows. The manure was applied in a green state, and became hard and crusty; fearing that it was not

fertile enough for plant-food in the early season, I spread on the top and harrowed in six hundred pounds of Cumberland Superphosphate to three-fourths of an acre. We then raked the land smooth, and on the 13th of May sowed, with seed-sower, Yellow Danvers Onion seed, at the rate of five pounds to the acre. Half the seed was new and half one year old. I think the new seed did the best. We hoed and weeded the bed four times, and weeded once when the onions were large. The crop was harvested in this manner:—We pulled four rows, threw them on the bed, then hoed the space and raked the weeds clean; we pulled four rows more and threw them on the clear space; hoed and raked as before, and so on through the whole bed.

Part of the onions were topped on the bed, the remainder carted to barn to be topped in unfavorable weather. The topping can be done much quicker on the bed if the weather is favorable.

Cost of raising crop on half an acre.

15 loads manure at $2.50,	$37 50
300 lbs. Cumberland superphosphate at 3 cents,	9 00
Ploughing,	2 50
Harrowing,	2 50
Raking,	2 00
Sowing seed,	1 50
Hoeing and weeding,	25 00
Pulling and topping,	18 00
Carting to barn,	8 00
Barrels,	35 00
Barrelling,	6 00
Carting to station,	6 00
Use of land,	10 00
Storing,	5 00
	$168 00
Amount of crop, 423 bushels to half acre or 147 bbls., at $3.50,	514 50
Net profit,	$346 50

The above statement is made by estimation, except the amount of crop, which was measured by David J. Woodman.

WORCESTER NORTH.

From the Report of the Committee on Root-Crops.

VEGETABLES.—"The object of every practical farmer is to grow from a given extent of land, the largest quantity of the most valuable product at the least expense; and at the same time with the least injury to the soil."

Experience ought to teach every farmer that here on our old sterile soils of Worcester North, it is folly to think that either cereals or root-crops without deep and thorough tillage, which is effected mainly by efficient ploughing, can throw out strong roots, luxuriant stalks and an abundant harvest.

It is obvious, too, that the little seed, after breaking the shell, delicate, thread-like as it is, cannot penetrate the soil unless it be made soft and fine; neither can these small rootlets extend their researches for food unless the soil has a corresponding depth and richness to feed upon; hence, thorough tillage must be resorted to, and this cannot be effected unless the soil itself be in proper condition at the outset.

All vegetables, in their various stages of growth, require air, warmth and moisture; otherwise life and health are not supported. Below the surface of the ground there is a body of cold, stagnant water,—sometimes, however, to great depth, but frequently near the surface,—and in retentive soils within a foot or so of the surface. Now this stagnant water not only excludes the air and warmth, but renders the soil wet and cold; and being of itself no benefit without air and warmth, its removal to a greater depth is desirable; hence underdraining, preliminary to deep tillage. In fact, a thorough pulverization of soil cannot be reached without the removal of the stagnant water below the surface.

As farm drainage is yet in its infancy in this section (Worcester North), questions are frequently put by young farmers, and those also of long experience: What lands require drainage? For what crops should soils be drained, and for what purpose?

To the first, it may be said that soils having comparatively a deep surface, soil impregnated with clay and retentive of

water so that willows and wild grapes make their appearance in the place of timothy and redtop, give evidence of standing water, from the fact that these water-loving plants would not have been found there, had not the stagnant water below the surface been present and encouraged their growth.

In reply to the second inquiry, it may be said that all cereals and root-crops require that water should be removed from twenty to twenty-five inches below the surface, for the purpose of giving deep ploughing, thus admitting air and warmth.

It has come under the observation of extensive root-growers on meadow and swamp lands, that if the water stand in the ditches only six or eight inches from the surface, then the root penetrates only to that depth, but refuses to go further; here it makes half a dozen little fangs or fingers, branching off sidewise; anywhere rather than into its enemy, cold water; and the result is a half-starved crop.

All cereals require the very opposite of wet, cold land, but a deep, loose, friable soil, and this cannot be reached when water is at or near the surface. It has of late come to the knowledge of observing cultivators, that the small roots of cereals extend many feet, instead of only a few inches, as was formerly supposed; hence when these small, tender roots come in contact with any pernicious substance, their growth is retarded, the stock grows pale and sickly; consequently, a meagre crop.

Stagnant water, again, is deadly poisen to young pear-trees and grape-vines; therefore, the young man who intends to embark in the cultivation of pears or grapes, should carefully study the nature of his soils,—their texture, location, aspect, etc.; and for any or all of the above-named crops, he should be satisfied with nothing short of a *deeply pulverized soil*, and this cannot be had when its foe is at the bottom.

Nursery-men and market-gardeners have long since learned that a well-drained soil, either naturally or artificially, and deep cultivation, have been their stronghold of success.

It was the theory of the early teachers of agriculture, that by having a soil free from water, and by giving deep and frequent ploughings, they would so much enrich the soil, that successive crops might be taken without the application of

manure; so we repeat, that draining our soils is a branch of improvement, and its principles little understood, and its advantages not fully appreciated, and we are not likely to learn much of either, except from experience and observation.

Having prepared the soil for tillage by underdraining, the next work of importance is effected by the use of that very useful farm implement, the plough. Although improvement within the last half century has been made in its construction, yet the advancement in its use has not been in the same ratio; neither, as a general rule, have our grass-lands or other lands been so well and effectually worked by the plough as they were fifty years ago, and for the simple reason that our boys and young men have not been trained to the work; for a man "*to hold the plough*" or let the plough follow the team, the ploughman having his mind and eyes on some other object is *one* thing; but to gauge the plough, give proper draught and cut a straight furrow, of uniform width and depth, and lay the same even and level throughout the field, is quite another. And not one in ten who has never been trained in the work is able to perform the task. It was truly said by an experienced farmer, that it required more skill and ingenuity to govern and gauge the plough, than for the builder to make one, as the mechanic has both rule and line to work by and guide him, while the ploughman has only his own eye and muscle to govern him. Hence, to become a ploughman, the individual must not only have an interest in and a desire for the work, but he must have no small amount of practice.

One object in ploughing is to make a mellow seed-bed for the plant, capable of absorbing the elements from the atmosphere, essential for its growth. The absorbing portion of the soil is in proportion to its fineness; the finer and more porous we make the soil, the greater the power of absorption. It is well known that if water, adulterated with barn-manure, be filtered through fine pulverized clay, it is rendered nearly pure; when drained through gravel it is less so, and if sand is used, the change is hardly perceptible. So that the finer we make the soils, in the same ratio will they retain those elements of the atmosphere necessary for plant-food. Hence, if we would have our soils retain the manure and fertilizers we put upon them, it is important that we make them fine and

porous. Although pulverizing the soil is not applying manure, yet it serves materially to aid the young rootlets in making their researches for food, and hastens the crop.

One object, then, in ploughing, is to break the stubble, and reduce the soils to that degree of fineness that the rains, dews and air may penetrate them, and deposit their fertilizing influences.

Another object in ploughing, is to mix and deepen the soils. It often happens that the surface-soil is sandy and the subsoil clay, or the surface-soil composed mainly of vegetable loam, and the subsoil wanting. Now it is important that these soils be mixed and made deeper and changed to a proper fineness, before they are fit to give sustenance to the young plant, and give more extensive range to the young rootlets. The depth to which land should be ploughed should be varied according to circumstances. We would not, however, favor the principle of turning up a large amount of subsoil at once, but at each successive ploughing, gauge the plough so that it may remove and bring to the surface about one inch more in depth than at the previous ploughing; this will add an amount of subsoil to the surface, equal to one hundred loads of thirty bushels each, to be converted into surface-soil, and this operation should be repeated till the required depth is obtained.

It was said, with much emphasis, nearly half a century ago, by a scientific and practical farmer, "Ploughing is too deep when it buries all the richer parts, and brings to the top only a cold, and gravelly substance, unless you have manure in such abundance, that you can create a new vegetable surface." This principle is as true to-day as then. It may also be said with equal emphasis, that ploughing is too frequent when the excess of crops does not fully compensate for the extra cost of ploughing.

Every observing farmer must have noticed that when imperfect ploughing has been done around trees and stumps, and about fences, that the crops are poor and feeble. This is not caused by the poverty or sterility of the soil, because, as the plough rises out of the ground to the surface, it brings with it, and deposits, the richer parts of the soil. The feebleness of the crop is caused by the indifferent ploughing, and consequently from poor tillage that the plant has received afterwards.

As before said, the rains and the atmosphere are not only charged with elements of fertility, but they are agents acting with heat in preparing food in the soil for the use of plants. Rains, heat and air should not only enter *into* but circulate *through* the soil. Stagnant water and stagnant air are alike hurtful to animals and plants.

The old cut-and-cover system of ploughing, is in vogue in 1873, as well as in 1823.

We remember, when boys, the object was *quantity* and not *quality*, regarding the complete breaking up and removing of the sod a matter of minor importance. Now, there will always be boys in the field, until the theory of good ploughing is better understood.

POTATOES.

Of all crops now grown in New England, in no other form can so large an amount of human food be grown from an acre, as in edible roots or tubers; and of these the potato is by far the most acceptable. Other roots are used occasionally, by way of variety, or as giving relish to other kinds of food, but the potato alone forms a part of the every-day diet to all.

SOIL AND PREPARATION.

The farmer who has dry, warm soil, well covered with decayed or decaying leaves or brush, may expect to grow from it a good crop of potatoes, provided the seed be sound and good, and under a clean cultivation. Grown on dry, new land, the potato always cooks dry and mealy, and possesses an agreeable flavor not usually found in those grown in any other soil. In no argillaceous soil can the potato be grown to perfection, as far as regards *quality*, although it may be so as far as it respects *quantity*.

To produce roots of the best quality, the soil should be dry, deep and porous, and to get a large crop the ground should be well filled with humus. Nitrogenous manures should always be excluded; if they must be used, it is far better to apply them to some other crop the year previous to growing the potato. An excellent manure for the potato is to mix one cord of well-seasoned muck with one cask of air-slaked lime, using salt liberally at the time of slaking, and applying about

eight cords to the acre. As soon as the shoots break the ground, a small quantity of some good fertilizer applied renders material aid in hastening the crop. Another cheap and profitable manure has been found by using one cask of pure bone-meal to the same quantity of unleached ashes thoroughly mixed together; let the heap remain upon the barn floor for a week or ten days, shovelling it over once in a day or two; apply this compost in the hill or drills at the rate of four or five casks per acre, using care to throw a small quantity of earth upon the seed before applying the compost. This has been found a valuable manure, costing only five-eighths as much as that of superphosphate, the best now in use, and producing quite as good results. As all fertilizers act quickly upon plants, compared with barn-manure, it is plain that the whole quantity should not be applied at once or at the time of planting, but one-half at the time of depositing the seed, and the remainder at the first and second hoeings, thus keeping the crop constantly supplied with plant-food during its growth.

To grow a heavy crop of potatoes at the present high price of land already denuded of its humus, together with the high prices of poor labor, it is necessary that all requisitions should be fulfilled; that is, we can't gather grapes from thorns, nor good potatoes from a dry, hungry soil without special care.

We remember, when boys, and living in Vermont, about sixty years ago, it was not uncommon for farmers to grow from three to four hundred bushels to the acre; now it is well known that half that amount is more than an average yield on the same ground.

This great falling-off in quantity cannot be attributed to the running-out of varieties, for varieties are yet extant that have not passed their prime; neither can it be caused by disease, for disease does not occur every year, nor does it enter every field; it may be traceable mainly to poverty in the soil in certain ingredients, or in other words, the soil is partially denuded of its humus. Now it is suggested that if one will plant on comparatively dry, suitable soil, enriched with leaves, seaweed, or by ploughing-in green crops till the soil is filled to a proper depth with vegetable matter, he will find that the

potato can yet be grown in Worcester North in full vigor and usefulness. The skinning process, so often alluded to, by taking from the soil all that is possible to take, and returning nothing to it again, is a ruinous operation to the farm as well as to the owner.

ONIONS.

As a general rule, any soil well adapted to the growth of Indian corn is well suited to the onion. Lands that slope in any direction should never be selected, as great injury is liable to be done in spring-time, by washing the seed or young roots from their bed; therefore, fields nearly level should be chosen; lands abounding with coarse gravel are always to be avoided; reclaimed meadow, with a light coating of sand, frequently gives quite as good return in quantity as any soil that can be chosen, although the quality is sometimes inferior; lands also abounding with stone are always troublesome. It has again and again been noticed, that in the preparation of the field each year, it apparently requires about as much labor to remove the stone as to perform the rest of the work. Fields overrun with weeds and troublesome grasses, should not be taken for onions, as there is no root-crop that requires so tender care in weeding; hence, if weeds have already deposited their seeds from careless or indifferent cultivation, it is far better to postpone the operation for another season, or until the seeds shall have become annihilated; neither will soil so wet as that it cannot be worked in early spring, give a good return of this crop.

The next important work is by the use of the plough; the depth should be varied according to circumstances; usually, however, quite shallow; say about four inches, but the finer, the better. The quantity of manure used and ploughed in, should be from nine to ten cords or even more per acre, and not only made fine and free from lumps, but well decomposed; after which a coat of wood-ashes or some other fertilizer should be spread upon the surface and well mixed with the soil. In about three weeks after planting, the surface should be moved, and continued to be moved once in eight or ten days, and, during the season, another light dressing of some fertilizer applied and worked into the soil, and the rains and dews by this treatment will much facilitate the growth of the crop. There-

fore, the great secret of growing onions is found in preparing the soil at the outset and by having a clean culture afterwards; one hour's work just at the time the weeds are ready to start, is of more value than a day's labor after they have gained a strong foothold.

The onion, unlike most other root-crops, may be grown on the same soil for a series of years, without any diminution of quantity or quality, provided the field be kept under a clean cultivation and fine tilth. The writer has known an onion-bed to grow this crop for twenty years, the last crop equal to the first.

Although six hundred bushels is considered only a medium crop, while eight or ten hundred is considered a large one, we would say to the young man, be not deluded in becoming rich at once by growing onions. Yet we believe, with having a suitable soil, patient and honest industry and near a good market, probably no crop for a series of years will pay better; but the application of manure, keeping the ground in good tilth and the non-cultivation of weeds, must not be lost sight of.

CABBAGES.

Fifty years ago, and even since that time, it was supposed that the only place for cabbages to make anything like a respectable growth was in very low, deep soils; consequently the lowest part of the farm was selected for the cabbage-yard. This was all very well, as this crop generally does well on such soils; such localities receiving the wash from the neighboring lands, the soil would be richer than elsewhere, and as the cabbage delights to work in a rich, friable soil, this was a wise selection.

It is now generally conceded that any good corn-land is also good soil for the cabbage, provided it be *well manured;* reclaimed meadow and swamp lands are also excellent soil for this crop when the water-level is kept at a proper distance from the surface; say from twenty to twenty-five inches. Within a few years we have witnessed as good fields with as solid and compact heads, as on any soil mentioned.

The cabbage, unlike the onion, generally requires a strong, heavy soil, and good animal manure,—any animal except the hog; if this be used, especially on wet soil, stump-foot gen-

erally follows, and this is death to the crop. If five or six cords of manure only are to be used, it is far better to apply the whole to half an acre, not only for the sake of saving a large amount of labor, but for the purpose of securing a better return, and leaving the field in better condition for the next year's crop; it is the last twelfth cord to the acre that gives the hard head and the heavy crop; but with half-manure, we may expect loose, spongy heads, and a light return.

From what we learn about growing this crop, it appears that, with a deep surface-soil resting upon a clayey bottom, with a liberal supply of barn-manure and fertilizers, any farmer need not demur or stand in fear of overstocking the market or selling at a losing price, as almost all farmers have or may have a home market, by feeding them to stock. Twenty tons per acre is not a heavy crop.

ROOT CROPS GENERALLY.

A *dry* soil is essential for the root-crops, yet *moisture* is beneficial to *all*, and is indeed indispensable to their growth; but *wet* is detrimental to *all* root-crops.

A *rich* soil is as necessary to grow good crops and particularly the root-crops, as nourishing and abundant food is for fattening stock. It is well known that poor pasturage and coarse forage may *keep*, yet it will not *fatten* stock; it is equally true that, although field-crops will live and grow upon poor soil, the product will be still greater in a rich one.

Last, but not least, a good after-culture is indispensable. This consists in keeping the surface constantly moved, killing weeds and thinning the plants; although the soil may be dry and rich and deep and well pulverized, yet the labors of the owner will not avail much if he neglect to keep the field clean from weeds. Crowding too many plants into a certain space is like overstocking a pasture, or making beef from half-feed; therefore, a moderate number of plants will give much better profit than a large number upon the same soil "crowded and huddled together." This is a hard lesson for farmers generally to learn; still it must be learned or ill-success must follow.

Finally, in the cultivation of root-crops, we have to say to the young man who intends to make root-growing a specialty,

be not deceived by those who may tell you that a thin, dry, hungry soil "will do about as well as any" provided you will cultivate and manure it. You may as well expect fertile ideas from a shallow brain by being educated with Latin and Greek; but be satisfied with nothing short of a *well-drained, friable soil.*

It is plain that agriculture has not kept pace in improvements with other pursuits, and doubtless from the fact that our young men, for the last quarter of a century, have been nurtured and taught in the principle that tilling the soil is low and degrading, instead of being healthy and honorable and independent; but as agriculture loses the services of our young men, and as our fields become deserted for other employments, it is in effect striking out of existence the spring season or having it forget to blossom. But what is wanted of our young men, is that they should accumulate facts that shall enlarge the mind and increase the understanding, by bringing into operation those hidden elements of mental perception and concentration; furthermore, it is not enough, that we simply collect facts and lay down rules,—that we arrive at just conclusions,—unless our observations are of the right kind and made in the right way. If they are not exact and accurate, and conducted and reported so as to admit of proper arrangement and comparison, they are of little value, and may lead to false and mistaken views.

As an illustration, Farmer Jones, who has gained a knowledge, by careful study and observation, of the composition of soils in his fields, and by knowing what elements are wanting for particular crops,—having also acquired a knowledge to some extent of fertilizers, and those best adapted to the soil and the intended crop,—reports to the Farmers' Club, or to the Agricultural Society of which he is a member, a complete success. Upon the receipt of this report, Farmer Smith, or somebody else, with a view of carrying off the palm by obtaining a higher premium, "starts off" with having a very limited knowledge of the elements in the soil, and still less of special manures,—perhaps uses two or three times the quantity used by his neighbor, and applies it in a different way, contrary to all theory or common-sense,—and instead of the experiment being like that of his neighbor, a success, the operation is a complete failure.

Hence the difference in the two farmers,—the one having some knowledge of the composition of soils, and knowing just how to apply manures and fertilizers, has made at least one movement towards "successful farming," while the other, having only a vague knowledge, or no knowledge at all of either, has made a similar step in the opposite direction; and thus it is that farmers have yet much to learn as to the nature of soils, the value of manures and fertilizers, and the way in which they should be applied to different soils and to the intended crops.

In closing, we have simply to say, that we consider our common and high schools defective, inasmuch as they teach comparatively nothing of the natural sciences, which are the basis of sound practical knowledge of things; and this is what no farmer, be it as it may, with others, can afford to be without. Teach our children as much mathematics as we will, and in as many languages as we please, but not until we have given them a well-grounded view of those sciences which they are to practice in after-life.

EPHRAIM GRAHAM, *Chairman.*

CRANBERRIES.

ESSEX.

From the Report of the Committee.

Mr. Hiram A. Stiles, of Middleton, is the only person who claims a premium, under the rules of the Society, for his experiment in the cultivation of the cranberry. On the 12th of Sept., the Committee visited Mr. Stiles, and viewed the grounds on which his experiments have been made. There we found a fine crop of berries, ripe and fit to be gathered. This was a very favorable time to view his crop, and to learn the result of his experiments. His method of preparing the ground for the planting of vines has been varied on different parts of his meadow, and the results have been different. Upon that part to which we were first introduced, he had spread a thick coat

of gravel or coarse sand, after having ploughed the ground. On those parts of his meadow treated in this manner, we found the berries much smaller in size and the vines far less productive than when the ground had only been ploughed and smoothed, without any top-dressing having been put upon it. From Mr. Stiles's experiments, as well as from our own experience in this business, we think that we may infer that the natural soil of our meadows is best adapted to the growth of the cranberry. No top-dressing has ever been put upon that particular spot of meadow on which Mr. Stiles claims a premium. The ground was only ploughed and smoothed, and the vines were set in the natural soil. No expense has since been incurred upon it.

On viewing this spot, we found the vines grown so rank as almost to prevent the grass from springing up among them. The crop upon these vines was abundant, the berries were of an extraordinary size, ripe and beautiful, and of an excellent quality. It was truly a fine sight to look upon. This was perhaps the largest crop that has ever grown upon these twenty square rods of ground, measuring twenty-three bushels, equal to one hundred and eighty-four bushels to the square acre.

Mr. Stiles has not always been able to keep his meadow flowed in the winter season, and no doubt his crop may sometimes have failed on this account. Unless our meadows be kept flowed during the freezing months, and drained during the summer, we can have no certainty of a crop of cranberries; but if this be done, perhaps no crop of fruit is so sure as that of the cranberry, unless some casualty happen to it, such as early frosts or the ravages of the cranberry-worm, that sometimes destroys almost a whole crop. Any bog-meadow that can be drained and flowed can be turned into a rich cranberry field; and there is much of this kind of land that can be made to yield a large income with but a trifling expense. We think well of Mr. Stiles's method of ploughing his meadow in preparing it for the planting of the vines; there are many advantages resulting from it. But there are meadows that cannot be ploughed; on such, cranberries can be grown with much profit without ploughing. We know of several such meadows, one in particular, on which so much as a peck of

cranberries had never grown since the recollection of the oldest man living. Some ten or twelve years ago this was drained by ditching; the peat taken from the ditches paid the expense of it. A small flume was built so as to flow the meadow in the winter to the depth of about four feet; this cost but about five dollars. The third year after this work was done, the vines, without planting, had grown so as to bear twenty bushels of cranberries. This is but a small piece of meadow, and from that time to the present the average yield has been from twenty to forty bushels per year.

GILBERT CONANT, *Chairman.*

PLYMOUTH.

From the Supervisor's Report.

CRANBERRY MEADOWS.—The cultivation of cranberries appears to be increasing, especially in the easterly portion of the county. Although the product of both natural and cultivated meadows may be, from year to year, provokingly uncertain, it is believed that all well planned and carefully conducted experiments in this branch of fruit-culture have proved reasonably remunerative, and many of them exceedingly profitable. One important consideration in favor of the extended cultivation of this crop, particularly in the vicinity of the seashore, a consideration which should commend itself to the attention of the owners of thoroughly-diked salt-marshes, is, that unlike other cultivated crops, it requires no manure,—the only elements essential to its production being peat, sand, air and water, which are almost everywhere to be found in unlimited quantities. The bringing together of these elements and their combination in due proportion, require the expenditure of labor and the exercise of judgment, but the probability of satisfactory returns is sufficient to warrant the outlay.

Statement of William H. H. Bryant.

I find among the papers of my late father, the following incomplete statement respecting the lot of cranberry meadow he entered for the premium payable the present year.

My lot set to cranberry-vines contains eighty-seven and three-quarters square rods. It was formerly a swamp-hole,

covered with maples and horse-briers, the mud being about two feet deep in the central portion and running to nothing at the upland. I commenced clearing it of turf, stumps, etc., in 1866, and covered about four square rods with pond and coarse hill-sand, say about three inches deep; set it to vines June 18 and 19, 1867. I also set, at the same time, one square rod without sand or gravel. On both these patches there were some berries the first year. I set a much larger patch in the fall of the same year, and the residue in June, 1868. A portion of those set in 1867 have been kept clear of grass and weeds, the result being a much larger growth of vines on which the berries set well in the spring of 1869, but not one in a thousand of them matured, the worms making almost a clean sweep of them, the destruction being much more complete where the grass was kept out than where it was suffered to grow. Thus far I can see no benefit from gravel or cultivation, except in the appearance of the vines. There is no regular stream of water passing through the lot, it being quite dry in the summer; but I keep it flowed in winter and until the last of April. I am experimenting with great care in the selection of vines which bear fruit of the first quality, having procured them from four different towns. As I keep a record of my proceedings, I shall be able, if living, to give the supervisor a full report of success or failure. I think spring is the best time for setting vines. I am unable to complete the foregoing statement, as my father would have been glad to do, if living. I find by his memoranda that the expenses of clearing, fencing, building dam, gravelling and setting vines, amount to about $400. In the fall of 1871 the cranberries were very fine, though not abundant, the yield being $2\frac{1}{2}$ barrels; in 1872 but about $1\frac{1}{2}$ bushels. The crop of the present year, the harvesting of which we have just finished, measures $60\frac{1}{4}$ heaping bushels,* such as buyers demand, making, I suppose, 20 barrels.

WM. H. H. BRYANT.

Statement of Benjamin W. Robbins.

The cranberry meadow I entered for premium contains 80 square rods. It was formerly low upland and brook meadow.

* Level measure is the statute measure for cranberries.

The upland was partially covered with small pitch-pines and bushes, which I caused to be removed in the fall of 1869, afterwards grading the whole by covering the low portions to the depth, in some places, of 12 inches, with sand carted from the upper part and from the higher ground adjoining. The clearing and grading cost $115. In the spring of 1870, I set out the vines twenty inches apart, at a cost of $25. Vines were scarce and not easily procured, or I should have set them nearer, and the dry weather prevented their spreading as they should have done. For these reasons the crop has been light as yet, the yield the present season being only nineteen bushels. But from comparison with other meadows upon the same brook, heretofore set, I think mine will hereafter prove productive and profitable, the fruit being seldom injured by frost, and the vines when well rooted, finding ready access to spring-water as it passes beneath the surface, from the adjacent upland to the brook.

BENJAMIN W. ROBBINS.

STOCK.

ESSEX.

From the Report of the Committee.

When will exhibitors understand that they "are required to give a written statement of pedigree," and that the judges cannot receive a bull as thoroughbred, simply because that word is prefixed? It would be well for competitors to remember this, if they expect premiums.

This rule, if adhered to, will, in the course of years, do more for the encouragement of breeding good stock than it is possible for our Society to do in any other way. That there is sound reason for this rule hardly any one at the present time would care to dispute. Merely to strengthen our position, I shall quote from a little book, entitled, "Cattle and Cattle-Breeders," by William McCombie, M.P., a breeder of many years' experience, one who bred for profit; and also from the writings of the "Northern Farmer," published in the "Farmer's

Magazine" for 1870. The former says: "Pedigree is of the most vital importance. We ought always to prefer a bull of high pedigree, with fair symmetry and quality, to another bull, though much superior in appearance, but of questionable pedigree." "Breeders have not given the subject the attention it deserves. I have paid dearly for my experience in the matter."

The latter says: "The surprising influence for good which the male of pure descent, of whatever the breed, exercises on the quality and character of the future offspring now well understood, no effort should be spared to procure purely-bred bulls, and on no consideration should a cross-bred animal be used. The extra price is not worth a thought, as by the time the progeny of the pure-bred bull have reached the age of twelve months, they will have paid, not only the difference between the pure and the cross, but the entire value of their sire, and that without extra feed and attention."

Farmers are apt to breed in a hap-hazard, careless sort of way, and, if luck favors, now and then get something they call pretty nice. Successful breeding requires the closest study. Darwin writes with much truth: "Not one man in a thousand has accuracy of eye and judgment sufficient to become an eminent breeder. If gifted with these qualities, and he studies the subject for years, and devotes his lifetime to it with indomitable perseverance, he will succeed and make great improvements; and if he wants any of these qualities, he will assuredly fail."

But you say, if not thus gifted, shall I give up breeding altogether? No, assuredly not. Strive to learn some of the great principles of breeding, learn from the experience of other breeders, take up their results, and go on; and though you may not become eminent, you may do much good and make many improvements in your time and generation.

As an example of an eminent breeder, the late Thomas Bates stands out prominently. At the sale of Charles Colling's short-horned cattle in 1810, Mr. B. purchased "Young Duchess," for 183 guineas. This, with another cow previously bought, was the foundation of the celebrated Duchess tribe, one of which, "the 8th Duchess of Geneva," at the auction sale at New York Mills last month, sold for the enormous

sum of $40,600, and will soon be on her way to England. At the same time, "the Second Duke of Oneida" brought $12,000; one hundred and eight head averaged $3,523.

At Colling's sale, "Comet," the highest-priced animal on the ground, sold for one thousand guineas, and forty-seven animals averaged a little more than one hundred and forty-two guineas.

There must be something in pedigree and blood when cattle sell readily at such prices. Grand results these, no hap-hazard breeding here; but the closest study and attention down the line of breeders from Colling to Walcott and Campbell.

The maxim, "penny wise and pound foolish," is never more fully verified in any business than in stock-raising. It is the poorest policy in the world to buy stock animals simply because they are cheap. If you wish to raise stock to sell, or merely to breed for your own pleasure, get the best at any reasonable price. If you do not, after years of patient waiting, you will regret, when perhaps too late to remedy your mistake, that spirit of false economy which persuaded you to purchase mediocre animals. *Cæteris paribus*, of course the cheapest are the best.

If a breeder wishes to make his mark, and see success in his own lifetime, he must be content to learn from the example and experience of his predecessors and contemporaries. Life is rarely long enough for a man to start out and establish a breed, although he may make vast improvements in existing breeds, and place many stones in the stairway which leads towards the summit of perfection.

Breeding is a science. The field for experiment is boundless; but only such men as Darwin mentions can reap a full harvest, although many may receive adequate and even satisfactory returns for the labor and expense incurred. Let us look at some of the principles of breeding as laid down by Prof. James Law, which should receive the serious attention of every one who desires to be a successful breeder.

The laws of variation, he says, are quite as important to study as the laws of hereditary transmission, for without variations improvement would be impossible. Among the causes of variation are mentioned food, climate, soil, use, disuse, reversion or breeding back, prepotency, imagination of the mother, the influence of a former pregnancy, disease and

accident. One can easily see the influence of food by noticing the difference between two herds of the same breed, the one kept by a generous, the other by a niggardly, feeder. High feeding, Prof. L. says, tends directly to variation and improvement.

Climate and soil have a marked influence on a race of cattle, which will be evident in its effects long after a removal to a dissimilar location. For this reason, we should be careful to select only such animals as are adapted to the climate and soil of our own farms. On this subject, the "Northern Farmer" writes, "It is highly necessary to take into consideration the class of animals that will suit the farm, it being much better to get them of a size rather under than over the capabilities of the soil, as in that case improvement will begin at once; whereas, if the opposite has been the case, the stock must recede.

"A man possessed of large capital can easily place on his land animals of immense bone and substance, and of the most approved breeds, but he cannot so easily alter the character of his soil and make it fit to carry such cattle; that must be a work of time, however great may be expenditure with the view of improvement; and consequently it becomes good, sound policy to keep both stock and soil progressing in the same ratio."

In selecting a breed of cattle, we should choose that which has been bred in a country as similar as possible to our own in climate, soil and its natural features.

Use and disuse of parts.—Cows in a wild state yield very little milk, and if our cows are not milked regularly and completely, the quantity of milk will decrease, or may cease altogether, whereas by the constant and proper use of the udder the flow of milk is continued. Cows that are worked, as often happens on the Continent of Europe, acquire in time stouter limbs and a heavier appearance than if kept for simple milch purposes. Swiss cattle are remarkably coarse and heavy-limbed for their size, in consequence of their almost daily efforts in climbing the steep mountain-sides.

Atavism, reversion or breeding back, is a subject of great importance, and a proper understanding of it indispensable for the breeder. Darwin mentions many curious cases of

reversion. He crossed a Black Spanish cock with a white silk hen; one of the offspring was almost exactly like the wild *Gallus bankiva.* Another experiment is mentioned, in which some West Highland cows were crossed with purely bred Shorthorn bulls. The cows were of a red color, and the bulls red, red and white, or dark roan. A considerable number of the calves were white, or white with red ears, and he says, it is highly probable that here the offspring reverted, in consequence of the cross, to the color either of the aboriginal parent species, or of some ancient and half-wild parent breed.

The same author writes: "As a general rule, crossed offspring in the first generation are nearly intermediate between their parents; but the grandchildren and succeeding generations continually revert, in greater or less degree, to one or both of their progenitors."

"With cross-breeds, the act of crossing in itself certainly leads to the recovery of long-lost characters, as well as of those derived from either parent-form."

In speaking of latent characters, he observes, "We can thus understand how, for instance, it is possible for a good milking cow to transmit her good qualities through her male offspring to future generations; for we may confidently believe that these qualities are present, though latent, in the males of each generation."

Agassiz has stated that "children are not only the children of their father and mother, but they are the children of their grandfathers and grandmothers; they are the children of the generations preceding them, so much that it is a well established fact that very often children resemble their grandparents more than they resemble their parents."

Thus we see the importance of a good pedigree and the value of a pure-bred ancestry. In my own experience, a case of apparent reversion has occurred in breeding Essex swine. Although I had good authority for believing that all my animals were descended from perfectly pure-bred stock, yet in a litter of eight pigs one was white with black spots, the others were entirely black. As the Improved Essex is supposed to have some infusion of Chinese blood, this would seem a probable instance of breeding back to the black-and-white Chinese hog.

Prepotency is a subject which should receive the careful consideration of every farmer who, although not a breeder of thoroughbreds, is a raiser of stock. On this point Law expresses his views so well that I shall quote liberally: ' Prepotency is less frequently the prerogative of the individual than of the breed which has been bred long and carefully to a particular type. Hence the great value of Shorthorns and other pure races in imparting to other breeds, with which they may be crossed, their own qualities to a proportionately greater extent than the share they have had in begetting them." " Crossing a pure, well-fixed breed with one whose characters are less fixed and constant, will bring the impure breed very quickly to the standard of the pure, and this will be a change for the better or the worse, according as this pure breed excels or comes below the other in personal qualities. Thus breeding our common cows with a poor aboriginal race of any country will *deteriorate* them rapidly, while crossing them with Shorthorns, Ayrshires or Dutch, will with equal rapidity *improve* them. Again, crossing these improved breeds with a poor but strongly fixed and prepotent breed will be at the risk of obtaining a reversion to a more primiti,e and still poorer type of the race. Crossing thus becomes an art, whose principles must be studied and acted on in order to succeed."

There are many well authenticated cases where the imagination of the mother seems to have left its impression on the offspring. It is related, on authority of Col. Bryant, Fairhaven, that a number of b'ack cows, sent to an island, had by accident a dun steer introduced among them, and that their calves were without exception of a dun color. Other instances of the same kind, especially among the lower animals, might be mentioned.

The effect of the first pregnancy on succeeding ones is a principle supported on the authority of Agassiz and others, and by many well-known instances which confirm their statements. I have noticed particularly in breeding dogs that the first pregnancy has had a most noticeable influence on after-progeny. This should be a warning to careful breeders not to allow their heifers to have connection with any but superior bulls.

Youatt, in speaking of disease, says there is scarcely a

malady to which the horse is subject which is not hereditary. If this is true of the equine, it can hardly fail to apply in some degree to the bovine species. Seeing that hereditary evil qualities may be transmitted with almost as great facility as good qualities, we cannot be too cautious in selecting for breeding only animals of good health and vigor.

Malformations and injuries from accident are closely allied to disease, and are governed by the same laws, though not invariably so. Law mentions the case of a cow having her horn knocked off, which afterwards had three calves hornless on the same side of the head.

Interbreeding is a subject of no little importance. Mr. Bates's views were these, that "to breed in-and-in from a bad stock was ruin and devastation, yet that the practice may be safely followed, within certain limits, when the parents so related are descended from first-rate animals." For thirteen years this celebrated breeder of Shorthorns bred closely in-and-in, but during the next seventeen years, thrice introduced fresh blood into his herd.

Nathusius, a careful observer and a breeder himself, writes, "from study and his own experience, he concludes that close interbreeding is necessary to ennoble the stock; but that in effecting this the greatest care is necessary, on account of the tendency to infertility and weakness."

Darwin declares that there is high authority for asserting that many more calves are born cripples from Shorthorns than from other less closely interbred races of cattle.

Thus I have presented, in a very incomplete way (for pages might be filled on every subject mentioned), some of the axioms of good breeding, theories they may be called by some; but unless they can be disproved by equally well-founded arguments, must be accepted by the fair-minded. At any rate, they present a vast field for research, inquiry and experiment, which every wise breeder will enter into with the determination of strengthening or weakening the principles laid down.

I have in this article quoted largely from authorities, whose opinions, based on careful observations and experiments, will, I think, carry more weight and awaken more thought than any simple essay on the subject.

J. D. W. French, *Chairman.*

MIDDLESEX.

Report of the Committee on Dutch Cattle.

Three animals were exhibited by Mr. Whiting, of Concord, —a bull and two cows. They were entered for exhibition only, there having been no entries of Dutch cattle in the entry-book handed to the chairman of the committee, and the assumption of the name Holstein, and the application of it to precisely the same race of cattle by the Holstein herd-book, require a re-opening of the question as to which name is correct.

If the Holstein breeders have no testimony other than that contained in their herd-book, the weight of evidence is so strongly against them, that an unprejudiced community will have no hesitation in applying to the cattle imported from North Holland, the name which rightfully belongs to them,—Dutch. If there is to be a collective name applied to the cattle of North Holland, that name is eminently proper. It is the name heretofore universally applied to them in this country, and recognized as their true name by undoubted authority in the country and the districts from which they have been imported. That cattle from Holstein were taken to Holland, and there bred in sufficient numbers to warrant the application of the name Holstein to the dairy-stock of Holland, meets from the farmers of Holland a universal and indignant denial.

If cattle a long time bred in Holland, acknowledged by their breeders to be Dutch cattle are not Dutch, what are they? They certainly are not Holstein, for all prominent historical writers, with one exception, admit, that the best cattle of Holstein descended from Dutch stock. Any one acquainted with the descendants of Dutch settlers in New York and Pennsylvania, and who knows the tenacity with which they cling to old customs, would hardly suppose their ancestors would go far out of their own country for cattle to improve their stock.

The Dutch cattle to-day in Massachusetts are the descendants of the oldest and purest blood of Holland, and contain not admixture enough of foreign blood to warrant a change of name. It is stated on page 19 of the herd-book, that five

animals imported in 1861 with one of a previous importation form the ground work of the present Holstein stock of this country, and the purity of the blood of those animals is certified to by the burgomaster of Opperdoes, the mayor and magistrate of Midwould, where they were obtained, and the secretary of the Dutch Agricultural Society for the district of Opmeer and by J. F. W. Korndorffers veterinarian.

It is also stated, that a description of the animals will perhaps convey to the reader a very correct idea of the prevailing characteristics of the "Holstein" cattle as they exist at the present time on the best dairy-farms in North Holland, and that the animals were procured from amongst the best breeders in the vicinity of the Beemster and Purmerend in the province of North Holland. That is the statement; but the burgomaster and magistrates of the corporation of the Beemster state, that not a single herd of cattle was or is ever imported from Holstein, and that, as far as is known to them, such a thing does not happen in a single province in North Holland—*and has never happened.*

The burgomaster of Opmeer, the burgomaster of Opperdoes and the burgomaster of Midwould, over their signatures, certify that no Holstein cattle are imported for the purpose of improving their cattle, and that in general the name of Holstein cattle is unknown. If the herd-book's own references deny the fitness of the name "Holstein" as applied to their dairy-stock, then its statements have no foundation in fact on which to rest, and are simply assumption without proof. In order that there may be no confusion on this subject in the future, and that the truth in regard to it may be known, it becomes the duty of every person and of every society to whom the matter may be referred, to examine carefully the authorities and to state clearly their convictions, so that the public may not be misled.

The animals imported by Mr. Whiting, with a record second to none in Holland, were of remarkable excellence, and commanded general admiration. They very nearly resemble, as I remember her, a cow owned by Mr. Leppleman, of Concord, about the year 1858, said to have been imported by Capt. Randall, of New Bedford. Mr. Leppleman took the cow to the Ayrshire bull "Prince Albert," imported

by the Massachusetts Society for the Promotion of Agriculture, and from that cross some of the best dairy-stock of this vicinity have descended.

Dutch stock and crosses from it are destined to take high rank as dairy-cows. My own stock for the past fifteen years have been largely crossed with the Dutch, and have proved very satisfactory as dairy-stock. The breed is an acquisition, and the gentlemen who imported it deserve for their public spirit and liberality the thanks of the entire farming community.

The following is a statement of J. G. Hengeveld, of Utrecht, author of the great work on European cattle, and intimately acquainted with the dairy-stock of North Holland:—

UTRECHT, November 8, 1872.

SIR:—After reading over the letter I had the honor of addressing you on the 20th ult., and in which I communicated to you my opinion concerning the "Holstein Herd-book," it appears to me that I have not been explicit enough in furnishing you with evidence sufficiently obvious to subvert the assumption or error of the "Association of Breeders of Thoroughbred Holstein Cattle," which association has given to the cattle imported into Massachusetts *from North Holland*, the name of Holstein cattle. For this reason, I now take the liberty of giving you a somewhat more detailed statement, based upon historical grounds, in order that the injured name of our excellent cattle may be retrieved in the United States, and the real name, that of Dutch cattle, which belongs to our breed, be given it. For this purpose, I beg to adduce the following:—

The testimony advanced by the "herd-book" to show the priority of the appellation "Holstein," rests on a quotation from the splendid work of the naturalist Low, of the following import, in speaking of the origin of the "Shorthorns" in England: "Cattle were frequently brought from the opposite continent and mingled with the native varieties. They were chiefly imported from Holland, the cows of which country were most celebrated of all others in the north of Europe for the abundance of their milk and the uses of the dairy. * * The

Dutch breed was especially established in the district of Holderness, on the north side of the estuary of the Humber, whence it extended northward through the plains of Yorkshire; and the cattle of Holderness still retain the distinct traces of their Dutch origin, and were long regarded as the finest dairy-cows of England. Further to the north, in the fertile district of the Tees, importations likewise took place of the cattle of the opposite countries; sometimes from Holland, and sometimes by the way of Hamburg from Holstein. Sir William St. Quinton, of Scampston, is said to have procured bulls and cows from Holland, for the purpose of breeding, previous to the middle of the last century; and at a later period, Mr. Michael Dobinson, in the county of Durham, visited Holland for the purpose of selecting bulls of the Dutch breed. Other persons had resorted for their breeding cattle *to Holstein, whence the finest of the Dutch breed have themselves been derived*." And a few lines farther on,—"the breed formed by the mixture became familiarly known [in England] as the Dutch or Holstein breed."

From this the "herd-book" infers that Dutch cattle and the cattle of Holstein are of the same quality or intrinsic value, and that the former are derived from the latter.

Let us examine this more closely.

The English "Shorthorns" owe their origin to cattle imported from Holland, but, besides these Dutch cattle, there have also been cattle imported (into England) from Holstein and Jutland. This appears from what is quoted in the "herd-book," from Low. The following is translated from Royer's * French version of Low's work: "In comparing these varieties of cattle to the breeds of the Continent, there is an analogy found on the one side between the great breed of the marshes, and the black cattle, natives of the plains and marshes of Holland; and on the other, between the more various kinds on the north of the Humber and these of Holstein and Jutland, whence the best cattle of Northern Europe have sprung. It is not unreasonable to suppose, that these latter breeds may have been introduced during the first period of Saxon colonization by the Jutes and Angles, who settled down in that

* D. Low's Natural Agricultural History of the Domestic European Animals, etc. Translated by Royer. The Races of Great Britain.

part of England. * * But at a more approximate period to us, it appears that cattle were frequently imported from the neighboring continent, and that they were mixed with native breeds."

"It was especially the Dutch cows that were considered the best milch kinds of Northern Europe."

There is here a very clear and evident difference made between the excellent Dutch cattle and the Holstein and Jutland breeds whose origin Low traces to a Saxon colonization. How Low, a few lines further on, can make the Dutch cattle derive their origin from the Holstein cattle, from which lines the "herd-book," draws its inference,—the same occurs in the French version, "whence the best Dutch races themselves originate,"—is incomprehensible; and it is evident Low errs, or is not sufficiently acquainted with the history of both countries. For already seven centuries before the colonization in England of the Jutes and Angles, the Friesians [Hollanders] were known for the greater number of their cattle, as will further appear.

The foregoing quotation from Low is the only one of any value contained in the "herd-book" in support of its theory, and this only demands attention because the statement of a great naturalist, although evidently a mistake.

The other quotations of the "herd-book," taken from English and American writers, American German papers, etc., as met with on pages 12, 13, 14, 38, 39, 40 and 41, prove only that the Dutch cattle are of the greatest excellence; and that the "herd-book," in repeating on page 40, what it quotes on page 13, from the German-American farmers' paper, "the original stock was by no means bred in Holland, but in Holstein," is not so much mistaken in the matter after all, as, for reasons which it is no object of mine to surmise, bent upon establishing its theory, that paper has perhaps also been led astray in the footsteps of Low.

Another remarkable expression is used—I had almost said another gross falsehood is broached—by the "herd-book," in tracing the origin of Dutch cattle to the Holstein breed, namely, on page 41. "Every spring, thousands of Holstein heifers are driven to the fields of Northern Germany and Holland, where people find it is more profitable to buy heifers than

to raise them; and the name of the breed got confused, so that the name 'Holland cow,' was here translated into 'Dutch cow,'" etc.! What, in the name of common-sense, next?

The "herd-book" takes the unwarranted liberty, whenever it should speak of Dutch cattle, of adding immediately after, the word "Holstein." It gives to Holstein cattle, *purchased in North Holland*,—and of which the first importation took place in Massachusetts in 1852, afterward in 1857, etc., but the greatest in 1861,—all the honor the Dutch cattle so abundantly deserve, and appears to have made the geographical blunder of supposing North Holland, Friesland, Groningen and Oldenburg as belonging to Holstein.

The thesis so arbitrarily adopted and set forth by the "herd-book," that the large black-and-white cattle imported into North America from the Netherland provinces of North Holland and Friesland, have "undoubtedly descended from the original stock of Holstein," as it proclaims on page 9, requires a most decided denial and refutation for the honor and reputation of Dutch cattle; and, without being led astray by the most strangely jumbled-up references mentioned, I wish to point out,—

1st. That the history of the Dutch or Holland cattle dates further back than that of Holstein;

2d. That the Holstein cattle descend from the Dutch; and

3d. That the name of "Holstein cattle" is only a local appellation for a peculiar indigenous breed, constituting only one of several appertaining to the same group, namely, to the group of the Lowland races, of which *the Dutch breed is the fundamental type*. To this I now proceed.

According to the "Allgemeine Deutsche Real Encyclopedia," * the origin of Holstein-Schleswyck lies buried in obscurity, and Holstein was probably visited by the Cimbri; while a century after, the Roman Emperor, Cæsar Tiberius, arrived with his army and fleet before the mouth of the Elbe, without, however, setting foot on the Holstein shore. According to Tacitus, it may be stated, that the Holstein Baltic coast was inhabited as far as Mecklenburg and Sleswyck, by seven petty German tribes, of whom the Angles and Warnes have preserved their names down to the present time; while

* Leipsic. F. A. Brockhaus, 1866, 8th part, p. 57, etc.

the others have been melted down into that of the Saxons. In the fifth century, the Saxons and Angles united with the Jutes and Friesians, and migrated to England. (This is Low's colonization.) Subsequently, the Holstein Saxons, who dwelt to the north of the Elbe, were called by the name of Normans; while the name of Holstein is not mentioned in history before eight hundred years after Christ. In 1128–64, the Holstein province Uagrien was conquered and converted to Christianity, and partly peopled with strange colonists from Friesland, Holland and Westphalia.

These are historical facts, agreeing with Low, and with what the editor of the "Massachusetts Ploughman," of 28th September last, quotes from a letter written by you to the following effect: "The first Dutch colony in Germany, then called by the general name of Thuringia, dates back as far as the year 528. From 801 to 864, St. Anskar, primate of Bremen, Hamburg, Holstein, etc., himself of Flemish birth, attracted many of his countrymen to those northern regions. Charlemagne, also, colonized Flemish peasants on the shores of the Elbe. That stretch of teeming lowlands, east of Bremen to the Baltic, wore a vastly different face in these early days. Marshy and uncultivated, the coast-edge of those parts stood exposed to the tender mercies of the sea to such a degree that even a slight breeze would suffice to cause immersion; while the inhabitants, through intestine wars, demoralized and habituated to strife and broils, evinced but little aptitude for the peaceful pursuits of husbandry. It was then that the attention of German princes was drawn to Holland, where similarly situated regions had been brought to a high state of productiveness. The great tide of migration, however, did not set in till the twelfth and thirteenth centuries, from which period the origin of the fine grass-lands along the Elbe and the Weser must be reckoned," etc.

I beg to refer the reader to the further contents of this important article, as inserted in the "Ploughman," just mentioned,* and take the liberty of adding that Mr. Mueller has therein strictly adhered to the historical truth.

From these historical statements it already appears that, with regard to its fitness as a grazing and cattle-breeding

* Since published in full, in the U. S. Agricultural Report for April, 1873.

country, Holstein is of later date than Holland; which fact will appear the more prominent, after some account has been given of the oldest inhabitants of Holland and their pursuits.

For this purpose I at once direct the attention of the reader to the coming of the Friesians and Batavians. The former were the oldest inhabitants of Holland, and were known as herdsmen, hunters and fishermen. Their history in this country goes as far back as 300 years before Christ. The Batavians came 200 years later (100 years before Christ), down the Rhine; and although they were likewise herdsmen, they occupied themselves more particularly with hunting and fishing.

The lands of the Friesians comprised the whole country to the north of the Rhine, as far as the shores of the North Sea, to which West and East Friesland belonged, composing the present Dutch provinces of Groningen, Friesland, Drenthe and North Holland, besides the provinces of Utrecht, Overyssel, and a part of Gulderland and South Holland. Of all these provinces, Groningen alone appertained to East Friesland.

Tacitus says of the Friesians and Batavians: "They owned cattle, not excelling in beauty, but in number." He further states, as does also Julius Cæsar, that the Friesians and Batavians paid each other in cows, sheep and goats, and gave likewise to their children as dowry, oxen adapted to the yoke and plough, cattle and horses. When they were subdued by the Romans in the first centuries of our era, the conquerors derived much advantage from this wealth in cattle, and imposed upon the Friesians an annual tribute, consisting of cow-hides and meat; while they chose their most valiant warriors from among the Batavians.

The Friesians and Batavians applied themselves to the draining of their marshy lands and their islands, created meadows on the reclaimed soil, which they first protected against inundations by raising hills, breakers and dikes, of which the traces are everywhere discernible along the coast throughout West Friesland and Groningen. Something is even known regarding the color of their cattle, namely, that they held those of a white color in religious veneration.

It is a very plausible theory that the Friesians, who, at as

early a date as three hundred years before Christ, peopled the north of the present Netherlands, and wrought those alluvial plains of Scandinavian clay into soil fit for the requirement of their cattle, did, in after-centuries, spread themselves in more northerly and easterly directions as far as the Elbe,—as we already know they did, in the fifth century, unite with the Jutes and Anglo-Saxons in emigrating to England; in addition to which we must observe that these were probably East Friesians and not West Friesians.

The East Friesians, from Oldenburg and the country near the mouth of the Elbe, both south and north of that river, were compelled, through the inclemency of those regions,—then in their original condition of low alluvial swamps, inundated at every tide,—to desert them. It was owing to these local circumstances that the Romans were prevented from endeavoring to land their army.

It can be shown that the inhabitants of this territory were unable to make sure provision for their own wants, because of the robberies and piracies committed by the Normans, dwellers on the west coast of Denmark, people from Holstein and Sleswyck, Jutes and Angles. These were by no means peaceful breeders of cattle, as were the Friesians and Batavians, whose lands they constantly plundered and laid waste, burning and ravaging their possessions, massacring the inhabitants, making them pay tribute, penetrating far inland to the mouths of the Rhine and Yssel, and everywhere giving unbridled vent to their ferocity and love of plunder. This was between the eighth and eleventh centuries. Giving due weight to these statements, which, from the nature of the case, must necessarily be brief, it cannot be doubted that the cultivation of cattle in the Netherlands existed a long time before such a thing could ever be thought of in Holstein. It is also quite as certain that the colonists from Friesland, Holland and Westphalia carried with them their cattle to Holstein.

Hence we see that, first, the Dutch race of cattle date from an older descent than those of Holstein; while, probably, second, the Holstein cattle originated from the Friesian breed and from that of the Dutch and Westphalian emigrants.

After this colonization, we have our attention directed to

another remarkable particular in the history of the Dutch-cattle cultivation. The "herd-book," unable to maintain the priority of the name Holstein from an earlier history of Holland and Holstein, might then, perhaps, seek its testimony in a later period, and the events to which your attention is now called.

From the fourteenth on till the eighteenth century, a large number of Danish oxen were annually turned for pasture into the grassy meadows of North Holland,—formerly West Friesland,—and sold at the weekly North Holland cattle-market. The oldest of these cattle-markets is that of the city of Hoorn. This market was already established in 1311, and, in 1389, the Danes and inhabitants of the Eyder were allowed by Albrecht, duke of Bavaria, to hold a weekly market there. In 1605, the Danish cattle-market was removed from Hoorn and transferred to Enkhuyzen, when, in 1624, the number of 1,179 oxen were sold.* There was also in Amsterdam a lean cattle-market, beginning in the spring, in the month of April, but held at irregular periods, depending upon wind and weather, when cattle were allowed to be conveyed from Denmark and Holstein hither to graze. These were mostly brought by vessel. †

These importations of Danish and Holstein cattle into North Holland, to which the "herd-book" might refer, did not consist of "heifers," as stated on page 41, but of lean oxen, which were pastured on the fertile meadows of the Polders, and afterward sold at the markets of Hoorn, Enkhuyzen and Amsterdam as fat cattle. As to heifers, either then or now, having been imported from Holstein into Friesland and North Holland for breeding purposes, no such thing is known.

To withhold nothing, and to put nothing in a distorted light, I may add, that in the middle of the 18th century several importations took place into Friesland of Danish cattle, consisting of young calves. This was at the time of the raging of the cattle-plague, which desolating disease carried off thousands of the finest cattle in Friesland and Holland.

For the purpose of keeping the cattle-trade alive, and to

* G. J. Hengeveld, Cattle, Vol. II., and G. Brank, History of Enkhuyzen.

† T. Domselaer, Description of Amsterdam, 1655, Vol. III., p. 194 and Vol. IV., p. 237.

fill the places of those destroyed by the plague, small Danish breeds and German cows of a diminutive size were substituted and crossed with the remaining and recovered natives.

"They were," says Scheltma,* "Danish, Holstein and small German cows, of which the greater part were smaller in size than the native race." In the same work we also find, "that one was reduced to the necessity, in 1769, of purchasing the needful cattle in the county of Bentheim, in the districts of Oldenburg and Munster, in Hanover and other parts of Germany."

In the work, "Present State of Friesland," it is mentioned that, "owing to the cattle-plague, the people were compelled to import from abroad all kinds of *small* cattle, chiefly Danish. But, what was remarkable, however small and ill-favored these animals might be, when compared with the handsome Friesian horned-cattle, as a natural consequence, an improvement of food induced a favorable development of body, and, from the mixture of the two breeds, good and choice milch-kine were attained within two or three generations of the introduction of the foreign blood, no matter how much the race had in the beginning deteriorated through the process, and, eventually, the type of Danish and German cattle was quite lost." This is, however, already one hundred years ago.

A fair consideration of what has been thus far stated will leave no justification of the "herd-book's," imputation upon the antiquity and purity of descent of our Friesian or Dutch cattle; or its assumption, that they are of Holstein origin. No; the genealogy of Netherland cattle is pure and unadulterated, and it is at least 2,000 years old.

I come now to the present time, and the question whether it is tenable to give to one variety of cattle the name of an entire group, and to reckon as appertaining to it all its several varieties or breeds,—as, for instance, the Dutch, Friesian, Oldenburg, Holstein, etc.,—and would it not be imperative in such a case to give it the purely historical name by which it is generally known? If it could be desirable to give a general name to the cattle of the just-mentioned districts,

* P. C. Scheltma. Treatise of the Society for the Promotion of Agriculture, Vol. XV., part 2, p. 3. Compare also "Cattle," Vol. II., p. 61.

then that of Holstein cattle would not be appropriate, and for it should be substituted that of *Friesian cattle*, whence all the varieties originated.

The chief characteristics of this Friesian breed—its eminent milk-giving and fattening qualities—we find in all the just-mentioned districts, and extending still further southward; with this difference, however, that wherever the land is more fertile, the climate milder, and the tending, feeding and breeding of the cattle observed with more care, in that measure, and according as these requisites stand to each other in the closest proportion and harmony, they are more developed, attain larger size and are of a finer texture.

If the intention be to convey a correct understanding of the true qualities of the several varieties or breeds mentioned in their own dwelling-places, it is better that each breed should retain the name by which it is known, and that no collective name, though an historical one, should be given them.

In order to be able to readily classify a group of cattle of great extent, possessing the same chief qualities in form and productiveness, Sturm* proposed, so long as fifty years ago, to give to a group, subject to the same conditions of soil and climate, a name indicating those conditions, and thus originated the designations, Mountain Cattle, Highland Cattle and Lowland Cattle. He also heads each of these divisions by the breed best representing the distinctive feature of its class, *as its type*. It is under the denomination of Lowland Cattle that he places the different breeds of cattle of the coast-lands along the North Sea. Schmalz, Pabst and many subsequent writers adopt this classification—some with a few modifications; but all find in the physical characteristics of the country to which they are indigenous, the general denomination of the collective group. According to Schmalz's statement, cattle, adopting Sturm's classification, may be distinguished in the following manner:—

A. *Lowland Race.*—Primitive cow; Dutch-Friesian cow.

B. *Mountain Race.*—Degenerate, quite the contrary of A; Swiss cow.

* Dr. Sturm: of Races, Crossing and Improvement of Indigenous Domestic Animals Elberfeld, 1825.

C. *Middle Race.*—Highland race; forms the transition from A to B; Frankish cow.

On page 55, Schmalz says, "To the race A belong the *Dutch, as representative*, the Friesian, the Oldenburg, and chiefly all Lowland races bearing the peculiar characteristics which identify it with the place of its sojourn.

"This is a purely natural division, and there is not the least arrogance in asserting, what history points out, that the Dutch cattle constitute the type of the oldest, purest and best breed. All other varieties are of less intrinsic value; they are coarser or smaller, possess less productive qualities, though of local excellence in their native places.

"*If cattle of the genuine breed are bought, imported elsewhere, and there bred, why is it not called by its native name, and why must an appellation be given to it quite foreign and unknown to it?*

"One hears in Europe of 'Lowland cattle,' but purchases of them for the purpose of improving other breeds have, for the last hundred years, been only made in the chief Netherland provinces, where the choicest cattle of the Lowlands are found. Thus, thousands of Dutch and Friesian cattle are annually sent abroad under the name of *Dutch cattle.*"

Finally, I beg to add quotations from Dr. George May,* director of the agricultural establishment at Weihenstephan, who visited Holland about ten years ago.

"The Dutch cattle constitute the type of the properly so-called Lowland race, which extends throughout Netherlands, Flanders, Normandy, Oldenburg and Denmark." Further on, page 41, he says: "The Oldenburg cattle descend from the Dutch race, and are likewise distinguished as East Friesian cattle, as still partially found in Hanoverian Friesland. In the adjacent parts of Bremen it is called Bremen cattle." On page 42: "The Holstein and Breitenburg cattle in the Wilster and Rempner marshes are equal to * * * but with respect to their square build, the Breitenburg cattle are in their properties more like the finer Dutch cattle."

Other writers of repute may be quoted, but enough has been given to show that the name of "Holstein cattle" is

* Dr. George May. The Cattle. Munich, 1863, Vol. II., p. 38.

only a local, and not a collective name, and may not be given to cattle bought in North Holland: to do so is to underrate the Dutch cattle race." *

Trust in the love of truth and fairness of the American breeders of Dutch cattle induces me to believe they will yet give to that race the name which is their due; that the appellation, "Holstein Herd-book," will be abandoned, and that we shall have, in its place, the Holland Herd-book.

Here, esteemed sir, I conclude my lengthy epistle, and apologize, at the same time, for the liberty I take in troubling you with my views in a somewhat tedious strain; but the honor of our Netherland cattle seemed to call for a word in its defence. Besides, I suppose there are breeders found in Massachusetts, who by no means approve of the name given by the gentlemen of the "herd-book" to our cattle, as is evident to me from some of the numbers of the "Massachusetts Ploughman," and from which I have reason to infer there are interests at stake involved in the name, of which I do not wish to judge.

With sincere esteem, I have the honor to be,

Yours truly,

G. J. HENGEVELD,

Teacher at the Netherland Royal Veterinary Institute.

To Mr. CHARLES MUELLER, United States Consul at Amsterdam.

This clear and explicit statement in regard to the cattle husbandry of Northern Europe, coming from authority so high and so far above reproach, ought to be regarded as perfectly satisfactory to an impartial and unprejudiced community.

SAM'L H. PIERCE,

Chairman of Committee on Dutch Cattle.

* Instances of the misinformation and confusion growing out of the present attitude of the "herd-book," may be found in Nos. 2, 3 and 18 of that register. The two former are Breitenburg cows, and the latter an Oldenburger, both of races distinct from and inferior to the Dutch, and owning to-day no common resemblance to that breed.

FRANKLIN.

From the Report of the Committee.

THOROUGHBRED BULLS.—The only object of agricultural reports should be to give practical information upon the matters treated of. Your Committee do not feel competent to give the subject such thorough consideration as its importance calls for. To do it complete justice, it requires a thorough knowledge of the principles of breeding and physiology, to which your Chairman cannot lay claim. Therefore any one who may peruse what may be here written, with a view of drinking deeply at the fountain of instruction, will be disappointed.

The improvement of our stock is certainly, as claimed by our breeders, a matter that can hardly be overrated. If any one has not worked up to this idea, let him cast back to the time previous to the injection of better "blood" into the veins of our cattle, when our *very best* two-year-old cattle, when butchered, would only on rare occasions come up to five hundred pounds, dressed weight, and so unthrifty or of so small capacity for growth as to hardly pay for their keep. Then let him compare what he can recollect of them, with what is patent to his senses now, when he beholds our best stock, which our best breeders and raisers annually exhibit at our fairs, and though as inclined to sleep as Rip Van Winkle, we think he would be thoroughly aroused. Whence came this better blood, that has made this desert of *scalawags* to "bud and blossom," and bear so bountiful harvests to the cultivator? Its origin was in the brain of man.

Observing the different degrees of excellence in different animals of the same species, the idea, or *inspiration*, was given him that, by breeding from none but the very best, and then from none but the very best of the progeny thus produced,—if, carried on with toilsome but never-flagging perseverance, the product of this great labor,—the outgrowth of this inspiration would finally culminate in the transformation of this field of sterility into a garden of Eden; or, if that be too poetical, we will say, he found his stock not only quadrupled in value, but that his bulls, bred in this manner, possessed a

power of engrafting scions upon the most unpromising roots, many times but little deteriorated, *never* blighted entirely, by circumstances, however adverse. When this point was attained, he had got what was called "blood-stock," or, in other words, "thoroughbreds." There would seem to be something in nature, however choice the blood (for breeding purposes), obtained by this in-and-in breeding, if not antagonistic to it, that seems to say, "thus far, and *no farther*." For the moment this "blood" overflows into other channels; it produces "grades" better than itself. No raiser of thoroughbreds, so far as the writer knows, will contend that such stock can favorably compare with grades for anything but crossing with something else. This being the case, it is not desirable to have a very large portion of our stock thorough—only enough to supply bulls—sufficient to bring them within the reach, at reasonable rates (which is not the case now) of all farmers. Exorbitant prices are charged for the service of bulls of this stamp, in many cases completely grinding out all efforts of improvement in this way, leaving only the road open for advance by way of using grades, and in very many, perhaps a majority, of cases, taking the old-fashioned scrubs.

But let us not disparage too much the grades for breeding-cows. Grades are good, very good, to breed from, if not too far removed from the fountain. The impress of the real thoroughbred remains stamped upon the progeny for many generations without going back to the original, growing fainter, it is true, as the gap widens. The writer knows this from observation in his own neighborhood. Austin W. Carpenter (now dead) many years ago obtained a bull-calf, a half-breed from the old Northumberland bull, and brought him to Leyden. Calves of that bull's get were equal, I think, to grades obtained directly from a thoroughbred sire. I do not know as to the certainty of transmission, but this I do know—that calves have recently been produced in this vicinity strongly showing their relationship to that animal, even reproducing the identical white mark on the flank. This, while it shows the value of grades as breeders, shows the great strength and certainty of transmission of the thoroughbreds. How very important, then, that what we call thoroughbreds have absolutely all imperfections of shape, temper, predisposition to

sterility or disease, bred out. No honest man will offer the services of a bull, and take a thoroughbred price, who is not as nearly certain as human and *brute* testimony can make him, that his animal is true to brand.

After all, is this improvement in breeds anything but a sheathing that the skill of man has added to the framework which he found at hand, and which is liable to drop off when neglected? Now, much of this excellence is maintained by good keeping, judicious selections and kind treatment.

It will hardly be contended that "blood-stock" *never* produces an animal unfit to breed from. So, after all, we have to be on our guard, lest we lose this artificial finish, and our stock drop back to where we started from. If but for a short time our vigilance be withdrawn, our patchwork, now so beautiful and excellent, will fall off, and leave us the old field, bare of our improvements, when we shall have to start anew, or wait for the slow process of development to bring our cattle up to the type intended for them by the great Architect.

One theory that thorough-breeders advance I consider erroneous; that is, that cattle, and, I suppose, other stock (and perhaps man), are more likely to transmit their bad qualities than their good ones; that is, if I understand them, if for instance, either sire or dam of any animal from which we propose to breed (I am now alluding to grades; of course thoroughbreds have no inferior relations) happen to be related, as they always are to progenitors, inferior in all, or at least many desirable qualities, then this animal is much more likely to perpetuate the undesirable qualities of its ancestors than to transmit any improvement upon the old stock which it may possess. This, if it be the law, renders improvement by selections impossible. The original thorough-breeders would have found themselves retrograding instead of advancing. No, I believe the law leads upward, and all that the skill of man does is to hasten that perfection which nature is finally leading to in all things.

One great error which we small farmers and breeders fall into, or overlook, is our inattention to our dams. We are constantly using any, however inferior, dams which we may happen to have, or can obtain, thinking if we can obtain the service of a tolerably good sire the progeny will be all right. Vain

and delusive hope! If we are to arrive at a certain perfection in the offspring, *both* parents must be perfect. This law holds good in regard to all animals, not excepting man. This certain transmission of qualities will be readily seen to be of great benefit in the rearing of our domestic animals if properly taken advantage of. If we wish to raise a good dairy, we should breed our best milkers to bulls regularly descended from a line of ancestors eminent for that quality; and, in this region, we should breed from no others, for the product of the dairy is the most important agricultural product to which our cattle contribute. Even if we wish for beef or work, we are not aware that the possession of a good milking pedigree (?) detracts in the least from those qualities; for which reasons breeders who are raising thoroughbred stock to supply the wants of New England with breeders, should begin to understand that everything in their line is *below par* that does not possess the power to transmit excellence in the dairy. This doctrine, or law of transmission, is a two-edged sword, and will cut to the quick in the wrong direction if the least impurity of the blood remains in our breeding stock. This is the doctrine of the thorough-breeders. We are all acquainted with what is denominated *breeding back*, that offspring are as likely, or more so, to put on the appearance of the grandsire or granddam, even farther back, as of the father or mother, especially if they descend from a race of long-established character. Thorough-breeders, beware that you do not sow tares with your wheat, for your tares, you say, are more likely to take root than the wheat.

We would like to put in our protest against the action of our State Board in regard to grade bulls, while thoroughbreds are not sufficiently numerous to be in the reach of all. As long as experience proves high grades vastly better to breed from than mere scrubs, and while good blood, as it is called, is not in reach of a vast majority of our farmers only through the grades, it seems to us, at least, premature for them to take such action as they have.

DAVID MOWRY, *Chairman.*

SWINE.

HAMPDEN.

From the Report of the Committee.

The raising and fattening of swine is to the farmer a matter of considerable interest. While there are differences of opinion respecting the healthfulness of pork as an article of diet, there are no classes, save the Jews and Mohametans, that publicly discard it. All over the civilized world, pork in some of its forms is used, and is considered almost indispensable. The pig contributes nearly as much as any other animal to the feeding of mankind, and its flesh is the most nutritious of animal food, pound for pound. Pork has been authoritatively pronounced the "prince of the kitchen," and without it, the many savory dishes of the housewife would lose their appetizing flavors. Fresh or salt, it is a product of reliability, and until the last layer is drawn from the pork-barrel, the means of a substantial household meal are ever at hand.

The products of the pig in meat, lard, oil, candles or bristles, will compare favorably in cost and profit with the products of any of the domestic animals, and the aggregate of their value in money is equally important. According to the census of 1870, the number of swine in the country was 25,134,569. At an average value of $7 per head, the whole value of the hog-crop would be $175,941,983, showing how important and immense is this branch of farm culture.

Pork-raising in Hampden County, and perhaps in New England, must necessarily be limited; yet, even here, with judicious care and prudence, it seems as if most farmers could profitably supply their own wants, and have a small surplus for the market. To enter into it as a business, in competition with the great corn-growing States of the West, is out of the question. Owing to their vast and cheap resources, it becomes with them a safe and legitimate business, and puts

all competition at defiance. With many of our farmers, especially those not engaged in doing business, it has become a serious question whether it is not more profitable to buy their pork and hams abroad, rather than to grow or buy corn, and raise and fatten their pigs at home.

In the profitable raising of swine there are some essential requisites. Attention should be given to the style of hog, and his feeding qualities, and also to the method of feeding. An animal of moderate size, quiet disposition, rapid growth, and early maturity is easily fattened, and would suit us much better than the larger and more restless breeds, which are great consumers, and require longer time for perfection. A cross between some of the larger and smaller breeds will be likely to combine the larger appetite and stronger digestion of the one, with the smaller body and quicker fattening properties of the other. A strong constitution, united to a quicker growth, is thus secured, and also greater chances of profit. The hog that gives the greatest weight in the least time, with the least cost, "between the cradle and the grave," is unquestionably the best.

The excrementitious matter of swine, next to night-soil, is the richest and most stimulating for plant-food, of all our domestic animals, and it should be carefully husbanded; but the health and comfort of the hog used for human food, should never be sacrificed on such a filthy altar. It is questionable whether a great deal of the alleged unhealthfulness of pork may not find a solution in the filthy manner in which the animal is often compelled to live, and the unwholesome garbage on which he is fed. We know that the conservative property of the hog's stomach is wonderfully powerful in overcoming the bad effect of poor food, yet we should prefer that the animals we eat should be fed with sweet, sound, wholesome food, and live in clean, comfortable quarters. The physical comfort of the hog is certainly worthy of more attention. His highest thrift and profit depend upon it, and neglect here as certainly tells, as when practised on a Jersey or a Durham. The manure-cellar under the barn is generally considered "a capital place to keep hogs," especially "store-hogs." All the excrement of the cattle and horses is thrown into it; straw and dirt may be added to some extent, and the hogs are there

kept to work it over. Frequently the stock, and especially the horses, are fed largely with grain; and this, whether thoroughly digested or not, finds its way to the cellar, and these half-fed hogs, with voracious appetites, root and chew it over, swallowing large portions of it. Now this may be some sort of an expedient for lazy farmers for working over their manure-heaps; but any one who will keep his hogs in this manner, and oblige them to root and wallow in this heating, seething excrement, inhaling the foul and noxious odors which are constantly arising from it, ought, after the work is accomplished, to kill these animals, and add their almost putrid carcasses to the reeking mass. They will in this way make excellent manure, but they ought never to furnish food for an intelligent people.

The hog is naturally a cleanly animal in his habits, and will never wallow in his own or others' filth if he can avoid it. The natural instinct of the animal causes him to root in the ground, not for manure composting, nor to gratify an innate nastiness, but to find the roots of grasses and other vegetable growths for food, and also to make himself a bed in which to lie, and in hot weather, to rid himself of his excessive heat. The hog has no process of sweating, like the horse. The immense amount of adipose or fatty tissue which covers his body prevents it, and hence in hot weather he seeks the cool earth and cool water in which to root and wallow and relieve himself from this great heat; but any one who will watch a pig, and observe his habits, cannot fail to see how carefully neat and nice he is in all his arrangements when he has the opportunity. It is generally when half-fed, and confined to a dirty hole, and compelled to live and lie in and on the excrement of his own or other animals, that he exhibits filthy habits. It is not his nature or instincts, but the filthy situation, which compels his dirtiness.

The process of fattening pork has been a subject on which opinions have largely differed. Some feed their growing stock on slops, with a little meal or bran, and a few roots. Where a dairy is kept, they get the skim-milk, whey and buttermilk. This is fed until they have attained a sufficient growth, when corn-meal fits them for the slaughter. Others begin the process of fattening as soon as the pigs are weaned.

They give them all they can eat of corn-meal, with a little bran, keeping up the process of growth and fattening until fit to be killed. Whichever method is adopted, the principal object, that of converting the pig into pork at the lowest cost, in the shortest time, should be kept in mind. It is not good policy to stint young growing pigs, and only to feed barely enough to insure their mere living. All that is fed to sustain life and repair disintegrating and wasting tissues, and keeping up the heat of the body, is only so much food given for a small return, while a very little more in addition, and all this is not only accomplished, but the increase of growth and thrift is more than sufficient to repay the cost of the extra food. The kind of food to be used in the period of growth depends somewhat on circumstances. Mr. Mattoon, of this city, feeds his growing stock upon bran and scraps until the time of fattening, then gradually diminishing the bran and giving corn-meal until the latter, with a few scraps, are given altogether. By this process his hogs are thrifty, rapidly attain their growth, and are soon ready for market. By the use of the bran and scraps, the quality of the excrement is also wonderfully increased in value.

Whatever method is adopted in the feeding and fattening of swine, it should be carried out systematically; the feed in quantity should be judiciously but steadily increased, and they should be made to eat all they possibly can. To this end a variety of food should be given them, for it improves their appetite, keeps them healthy, and accelerates the fattening process. Clover, for young or old hogs, is not only a cheap, but a most appetizing substance. It improves the digestion, regulates the secretions, and assists in producing a more perfect assimilation of the higher concentrated food.

Finally, a plenty of good, sweet, wholesome food, dry, clean, and warm quarters, and system and regularity in the feeding, will keep your swine healthy, and with good, judicious management, will afford, in their pork and in the manure which they will make, a more profitable return for the time, the trouble and expense bestowed upon them, than is sometimes supposed.

P. LeB. Stickney, *for the Committee.*

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